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AN EVALUATION OF FLUID MILK QUOTA POLICIES IN ALBERTA

University — Université
UNIVERSITY OF ALBERTA

Degree for which thesis was presented — Grade pour lequel cette thèse fut présentée
MASTER OF SCIENCE

Year this degree conferred — Année d'obtention de ce grade
1980

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THE UNIVERSITY OF ALBERTA

AN EVALUATION OF FLUID MILK
QUOTA POLICIES IN ALBERTA

by

Ⓒ GERD GUSTOF ANDRES

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE

IN

AGRICULTURAL ECONOMICS

DEPARTMENT OF RURAL ECONOMY

EDMONTON, ALBERTA

FALL, 1980

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

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in partial fulfilment of the requirements for the degree of Master of SCIENCE

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Date October 3, 1980

DEDICATED TO MY PARENTS

ABSTRACT

In Alberta, the regulation of the fluid milk sector is administered by the Alberta Dairy Control Board and the Public Utilities Board. These agencies administer the regulation of the supply of fluid milk by means of a system of quotas, administer the price of fluid milk and administer federal regulations and policies. This study is concerned with these programs, and particularly with fluid milk quota policies, regulations, and values.

Fluid quota data covering the years 1975 to 1979 were obtained from the Alberta Dairy Control Board. These data cover Alberta except for the Peace River area. Quarterly average weighted fluid milk quota values in Alberta during this time ranged from $2.25 to $28.25 (per daily pound). In the fourth quarter of 1979, this value decreased to $6.25. The high average value of $28.25 per pound in Alberta in 1978 was mainly due to high quota values in the Calgary-Lethbridge area. In the Edmonton area over the time covered by the study, average fluid quota values ranged from $2.25 to $16.00 per pound, with $4.00 per pound being the average value in the fourth quarter of 1979.

The majority of fluid milk producers in Alberta produce from 1,000 to 2,500 pounds of milk per day, with the average being 1,855 pounds per day (1979). With quota values at the levels which have prevailed, the cost of the right to produce fluid milk has been high at times. Areas of concern that have arisen from the system of fluid milk regulation and which are discussed in this study are the capitalization of quota benefits into quota values, the barriers to entry created by quota systems, and some of the resource misallocations which can arise from them. Capitalization reflects higher expected income to fluid quota owners. Barriers to entry can occur because of the potential high cost of purchasing fluid milk quota. Resource misallocations can arise because of the supply control program and also because of constraints on geographical shifts of fluid milk quota.

A major objective of this thesis is to examine, using a single-equation regression model, the relationship between fluid milk quota values in the province of Alberta and in the Edmonton milkshed with selected economic indicators. These are: the difference in price between fluid and industrial milk in Alberta, beef prices in Edmonton and Calgary, and the sub-components of the "composite" index used in the pricing formula for fluid milk.

The models were tested in both linear and double logarithmic form. The results indicated that average steer prices were related inversely to fluid quota values and were significant in all models where steer prices were included as a variable. The variable of fluid-industrial milk price differences was significantly related to quota values in two of the five models which included this variable. In addition, three production cost indices--farm inputs, 16 percent dairy feed, and alfalfa hay--were significantly related to quota values.

An additional objective of the study is to examine and evaluate the major features of the system of formula pricing of fluid milk in Alberta. Some advantages and disadvantages associated with this method of administered pricing are outlined. Forms of formula pricing used in other provinces are briefly compared.

The study recommends that fluid milk quota values and their perceived determinants be recorded over time by either Alberta Agriculture or the Alberta Dairy Control Board. In addition, a simplification of the

complex regulations of the milk industry (federal and provincial) is recommended. In particular, changes in present Alberta quota policy such as the geographic restriction on quota transfers should be considered by the Alberta Dairy Control Board. Also, a re-evaluation of formula pricing in its present form (1979) should be undertaken.

ACKNOWLEDGEMENTS

I wish to express my appreciation and sincere gratitude to Dr. M.M. Veeman for her guidance, inspiration, and assistance during the realization of this study. I would also like to express gratitude to Dr. W.E. Phillips for his valuable assistance throughout my studies and writing of this thesis. To Dr. G.P. Reschenthaler, I extend gratitude for his valuable comments.

Thanks is extended to the Production Economics Branch of Alberta Agriculture and the Alberta Dairy Control Board for their assistance in providing information for this study.

Special thanks are extended to the Department of Rural Economy staff and my fellow graduate students for their encouragement and assistance, particularly Clare C. Shier and Jim Copeland for data processing and Wendy Williamson for typing and proof-reading the manuscript.

Sincere thanks go to my parents and friends who deserve much of the credit in helping me pursue my educational career thus far.

Above all, I would like to thank Evelyn for her love, patience and endless support throughout the difficult times in writing this thesis. As well, to all others who helped me in any way, I say "thank you."

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CHAPTER I

INTRODUCTION

The Canadian Dairy Industry appears to be the most regulated agricultural industry in Canada. In Alberta, the regulation of the fluid milk sector is administered by the Alberta Dairy Control Board (ADCB) and the Public Utilities Board (PUB). The system these agencies administer was originally put in place to remove "boom and bust" cycles from an unstable industry and to ensure producers a "fair return". Lately, however, the above agencies and similar boards in Canada have been highly criticized for their lack of concern regarding consumer interests or the "public interest". As in other provinces, the system of regulation appears to have maintained fluid milk prices above the level which would have prevailed in a more unstable unregulated market by regulating the supply of fluid milk. This regulating of fluid milk supply has been achieved by means of a system of administered pricing and fluid milk quotas. These regulatory activities are sanctioned by legislation and are legally binding.

The Nature and Scope of the Problem

Milk production in Alberta has historically been characterized as unstable. There have, at times, been erratic production cycles and relatively low incomes for milk producers. Producers, therefore, have preferred an organized or regulated market for milk, because of its ability to provide economic stability and security. These features led to the establishment of the regulatory system under which supply is regulated and prices are administered. These activities and the types of agencies that administer them have also applied in other provinces for milk and for some other agricultural commodities.

The milk producing industry has traditionally been differentiated into industrial and fluid milk producing sectors. Originally, this differentiation was due to different quality standards in the two sectors. Today, however, the difference is largely in the uses of these two categories of milk, that is, between those products which are processed and can be stored, and those products which are relatively perishable and must be consumed within a shorter period. The federal government regulates industrial milk (since industrial products, e.g., cheese, are traded across provincial boundaries and in international trade), while the provincial government regulates the fluid milk sector whose major products are consumed locally. The method followed by both governments in regulating these sectors is essentially the same. It involves regulating supply and administering prices of milk in its various forms through its agencies.

The regulatory agencies are the Canadian Dairy Commission (CDC) and the Alberta Dairy Control Board (ADCB). Essentially the CDC regulates industrial milk supply by means of market-sharing quotas (MSQ), while the ADCB administers a system of fluid milk quotas. In addition, the Public Utilities Board (PUB) of Alberta administers fluid milk pricing at the producer, processor, and retail sales levels in Alberta. The producer price of fluid milk is administered by a formula which computes eight components into one index, on which the level of fluid milk prices is calculated.

One feature of the fluid milk quota program and, to a lesser extent, of the MSQ program, is the feature of the capitalization of the expected future streams of net benefits from the ownership of quota into its present value. That is, the anticipated net returns from producing fluid milk are apparently higher than such other uses of producers' resources as producing industrial milk, since fluid milk quota has a value. Thus, when the expected stream of net income benefits from fluid milk production are anticipated to be relatively high, the value of fluid milk quota can also be expected to be relatively high. When the expected stream of net income benefits is relatively low (relative to other production alternatives) or is decreasing, the value of fluid milk quota is likely to follow a similar pattern.

One major purpose of this study is to examine, to the extent that available information permits, the nature of the influences on fluid milk quota values in Alberta. A related evaluation of the formula pricing system for fluid milk is undertaken in an effort to determine the relationship of the formula and its components to quota values. A regression model exploring these relationships is tested. Particular attention is placed on examining the effects of those formula components which reflect production costs. In addition, the price of beef cattle is included in this analysis as an indicator of gross returns from an alternative production enterprise. This quantitative analysis focusses on the time period from 1975 to 1979.

Study Objectives

The major objectives of this study are to document, examine, and assess the main economic effects of the quota program for fluid milk in Alberta. Specific objectives of the study are:

1) To outline a brief history of dairying in the province;
2) To describe federal and provincial policies, regulations and programs for the sector;
3) To examine and evaluate the major features of the system of formula pricing of fluid milk in Alberta;
4) To document and to evaluate the major economic effects of fluid milk quota policies in Alberta;

5) To examine, using statistical techniques, the relationship between fluid milk quota values and the selected economic indicators of:
    a) the difference in price between fluid and industrial milk in Alberta;
    b) the "composite index" used in the pricing formula;
    c) beef prices in Edmonton and Calgary;
    d) those individual components of the "composite index" which reflect production costs; and
6) To indicate areas where improvements in the regulatory system can be made.

Study Outline

Chapter II contains a brief history of dairying in Alberta from 1885 to 1979. Chapter III provides background information regarding federal involvement in the dairy industry. Information on the CDC, market support and purchase programs, MSQ, and industrial milk pricing is presented in this chapter. Chapter IV provides information on the provincial policies, programs and regulations which apply for milk in Alberta. In particular, this chapter reviews formula pricing and quota policies for fluid milk in the province.

Chapter V consists of a review of literature and provides a theoretical framework for analysing quota values. In Chapter VI, the methodology and models used in the study are discussed. In Chapter VII, the results of the quantitative analysis of the relationship between fluid milk quota values in Alberta and various economic factors are presented. The final chapter, Chapter VIII, provides a summary of conclusions from the study and presents a number of recommendations.

CHAPTER II

A BRIEF HISTORY OF DAIRYING IN ALBERTA

The establishment of the dairy industry in Alberta was associated with the construction of the Canadian Pacific Railway (CPR).[1] Dairy herds were established in Calgary and Edmonton with the completion of the CPR's trans-continental line in 1885, and the rail connection between Calgary and Edmonton in 1891. By 1888, commercial production exceeded household fluid milk needs, resulting in the establishment of the first dairy factory in Calgary which took advantage of eastern and western markets due to rail connections. In 1897, a further impetus to dairying was derived from a general reduction in freight rates under the Crow's Nest Pass Agreement. These freight reductions, plus the need for dairy products resulted in the shipment of dairy products to the mining and lumbering centres of British Columbia and the Yukon.

With the growth of the dairy industry between 1890 and 1905, cheese factories and creameries sprang up in several areas, particularly in Calgary, Edmonton, and areas adjacent to the Calgary-Edmonton railway line. However, few of these factories were successful. Inadequate cow populations and insufficient and irregular milk supplies forced many factories to cease operation and caused others to suffer financial difficulties. As a result, the federal government (the province of Alberta was not yet formed), provided an impetus to the dairy industry by means of a "North West Territories Creamery Program". This program provided financial backing and managerial personnel in operating creameries and cheese factories. The program also encouraged farmers to build up their dairy herds, factories to improve the quality of their dairy products, and the dairy industry in general to introduce new techniques.

---

[1] The following historical material, except where explicitly noted, is from: Chester F. Prevey, "The Development of the Dairy Industry of Alberta." Unpublished M.A. Thesis, University of Toronto, Toronto, Ontario, 1950.

In 1905 the province of Alberta was formed. This formation led to the withdrawal of the federal government from active operation of creameries in Alberta. These creameries (12 altogether) had been managerially and financially assisted by the federal government, but the creameries themselves were all owned by local farm associations.

On May 1, 1906 the Dairy Branch of the Alberta Department of Agriculture started operations. This event coincided with the takeover of all federally controlled creameries in Alberta by the newly-formed provincial government, an activity which involved the marketing of butter plus plant management. Five years later various associations took over the managerial aspects of the above creameries but the government continued to market the butter from all creameries (including privately owned creameries) in Alberta until 1927.

The period from 1906 to 1914 was one of rapid expansion for the dairy industry of Alberta. New technological methods were introduced from other parts of the world. Notable amongst these were the use of the Babcock test,[1] use of cream separators, and pasteurization of fluid milk. In addition, the development of homogenized milk, "supenior" milk (milk that tested 10 percent butterfat) and the changeover from "domestic type" butter (high in color and salt content) to "export type" butter (similar in taste, color and flavour to New Zealand butter) was introduced.

During the above period, the provincial government introduced regulations for the dairy industry by way of the Dairymen's Act. Part I of this act was passed in 1907 and part II was passed in 1910. This act dealt with the registration of associations, sanitary inspection of creameries, cheese factories, farm dairies and for the appointment of dairy inspectors. It also provided standards for sampling and testing milk and cream, plus record-keeping by creameries and cheese factories.

---

[1] Named after Stephen Babcock, this test provided for a simple method of measuring the butterfat content of milk. The test discouraged milk adulteration and aided in factory manufacturing of cheese and butter.

The period from 1914 to 1924 witnessed a further rapid expansion of the Alberta dairy industry. This was due to increased demand for dairy products during World War I and was also a result of the increasing population of western Canada. After the war, expansion continued, leading to a problem of "surplus" milk supplies in Edmonton and Calgary. This led to the establishment of fluid milk producers' associations to act as collective bargaining agents for producers.

A major readjustment in the industry occurred between 1925 and 1929. The rapid expansion which had been experienced previously came to an end. Alternative farm products became more attractive because of improved prices, particularly for beef and wheat.[1] Another feature of this period was government encouragement of cooperatives to process and market agricultural commodities.[2] As a result, a number of dairy pools were formed. Notable amongst these dairy pools were the Northern, Central, and Southern Alberta Dairy Pools. With the appearance of these dairy pools, the provincial government terminated its marketing activities.

During the 1925-1929 period, an important new dimension occurred in the industry as farmers tried to switch from the production of manufactured milk to more profitable fluid milk production. To limit the transfer of manufactured milk producers into fluid production, the city health authorities in Edmonton and Calgary limited the area from which milk could be drawn to within a 15 mile radius of the city. In addition, to ensure an all-year-round milk supply, the milk producers' associations and distributors agreed to a quota system of purchasing milk only from members of the association. These quotas were determined on the average daily quantity of milk each farmer delivered during the months of least production, namely the winter months. The highest milk price would be paid for quota milk. Surplus milk in excess of these daily averages received a lower price. Once these quotas were established, new producers were barred from entering the fluid market unless a producer purchased an existing shipper's quota. The price for these quotas was whatever the market could bear.

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[1] Austin A. Lupton, "Some Georgraphical Aspects of Dairying in Alberta." Unpublished M.A. Thesis, University of Alberta, Edmonton, 1965, p. 30.

[2] The government at the time was the United Farmers of Alberta which advocated cooperatives and farmer organizations.

The price of milk was set several times a year by means of negotiations between producers' associations and distributors. The producers' associations, with the protection of the barrier to entry into the industry provided by the quota provision, bargained individually with the distributor. The distributor, in his negotiation with the producers associations was guided by consumer demand and the possibility of new distributors entering the market. The basic producer milk price for 3.6 percent milk from 1926 to 1929 in Edmonton ranged from \$2.33 to \$2.63 per 100 pounds (hereafter \$/cwt). The price to Calgary producers was similar. The retail price of milk averaged from 10 to 12½ cents per quart during the same period.

During the early 1930s, the dairy industry in Alberta experienced very low prices. Prices for agricultural commodities, including fluid milk, were generally low relative to operating costs. In order to supplement farm incomes, many farmers were forced to milk cows for additional revenue. Established milk producers who had invested heavily in their dairy operations were faced with serious economic problems. In view of the chaotic economic period, established milk producers appealed to the provincial government to institute price controls on fluid milk at both the producer and consumer levels. Thus, in February 1933, fluid milk in Edmonton and Calgary came under public control by an amendment to the Public Utilities Act. The Board of Public Utilities Commissioners (PUB) was empowered to conduct public hearings, make judicial decisions regarding fluid milk pricing, set minimum producer and consumer prices of milk, and regulate milk quotas.[1] Within a short time of this board's activities, the economic position of the fluid milk industry in Edmonton and Calgary was improved. Following this change, further milk controls were implemented in other areas.

By the early 1940s, the PUB had improved the economic position of the fluid milk industry. This position had been accomplished by: (1) raising both the basic and surplus price of fluid milk; (2) limiting the number of producers and distributors by means of endorsing former quota policies and licensing of distributors; (3) setting the price of retail milk; and (4) eliminating producers who were incapable of producing fluid milk all year round.[2]

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[1] Veronica McCormick, A Hundred Years in the Dairy Industry. Ottawa: Dairy Farmers of Canada, 1968, p. 98.

[2] Chester F. Prevey, op. cit., p. 192-194.

During the early 1940s, the dairy industry in Alberta expanded at a rapid rate due to the lack of foreign and domestic competition. This lack of competition was the result of World War II and the regulations of the Agricultural Food Board and Dairy Products Division of the Wartime Prices and Trade Board.[1] The postwar period saw a slight decrease in dairy production, but a steady increase in dairy product prices. A notable event in 1949 was the federal passage of "An Act Respecting the Regulation of Control of Margarine". In this Act, margarine could not be colored yellow and that if served in public eating places as a substitute for butter, notice of the fact must be given.

In the 1950s, the dairy industry in Alberta became much more specialized as farm operations became larger. Important events during this decade were the introduction of such technical innovations as bulk milk tanks, milking parlours, and artificial insemination. These innovations resulted in increased herd size and milk yields per animal. In 1951, the average herd size under the Provincial Cow Testing Service was 16.8 cows.[2] In 1960, the average was 25.7 cows.[3] Average milk yield per animal in 1950 was 4,617 pounds (166.2 pounds butterfat at 3.6 percent) compared to 5,917 pounds (207.1 pound butterfat at 3.5 percent) in 1960. Although both production per animal and herd size increased, the total number of cows decreased by 20,800 over the decade.[4]

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[1] Austin A. Lupton, op. cit., p. 34-35.

[2] Alberta Department of Agriculture, Annual Report 1951, Edmonton, 1952, p. 69.

[3] Alberta Department of Agriculture, Annual Report 1961, Edmonton, 1962, p. 74.

[4] Alberta Department of Agriculture, Annual Report of the Dairy Branch 1962, Edmonton, 1963, p. 19.

During the 1950s, the manufacturing sector of the dairy industry experienced problems. Accumulation of stored stocks of butter applied during this decade. As a result of price support activity under the Agricultural Products Act of 1947 and the Agricultural Stabilization Act of 1958, the federal government supported a price support program. Import restrictions on butter were also applied. The cost of the butter support program from 1950-1951 to March 1958 was estimated at $16 million.[1]

In the 1960s, many farm improvements were made. The conversion to bulk tanks proceeded. These increased from 737 in 1961 to 1,305 in 1970. The number of herds under the provincial testing service increased from 455 in 1960 to 504 in 1970. Average herd size also increased from 25.7 cows in 1960 to 41.4 cows in 1970. Average production per cow increased from 5,915 pounds of milk in 1961 (207 pounds of butterfat at 3.5 percent), to 7,721 pounds in 1970 (270.2 pounds of butterfat at 3.5 percent). Also during this decade, the total number of licensed fluid milk and cream producers decreased from 1,001 in 1961 to 759 in 1970, a reduction of 24 percent. This reduction was associated with a decrease of 90,000 cows (approximately 31 percent) and 192,000 pounds of milk (approximately 11 percent) during the nine years.[2]

In the 1960s the fluid and manufacturing dairy sectors also experienced institutional and policy changes. In the fluid sector the major changes were: (1) the amendment in 1964 of the Margarine Act to permit the coloring of margarine to a deep shade of yellow; and (2) the establishment of the Alberta Milk Control Board in 1969. The Board was made responsible for enforcing regulations and orders with respect to the production, processing, supply transportation, distribution and sale of milk in the province. The Public Utilities Board (PUB) retained jurisdiction over the pricing of fluid milk at the levels of producers, processors, and retail sales.

---

[1] J.W. White, "The Canadian Dairy Industry in Retrospect." Canadian Journal of Agricultural Economics, C.A.E.S. Workshop Proceedings, 1971, p. 10.

[2] Alberta Department of Agriculture, Annual Reports of the Dairy Branch and Alberta Milk Control Board. Various issues between 1961 and 1970.

In the milk and cream manufacturing sector, the major event was the establishment of the Canadian Dairy Commission in 1966. This body was given powers to administer federal support funds, determine payments for milk and cream, and exercise control of interprovincial and export trade of butter, cheese and skim milk powder. The Commission undertook a form of supply management by introducing Subsidy Eligibility Quota (SEQ) in the 1967/1968 dairy year. Each producer who delivered manufacturing milk or cream in 1966/1967 was allotted a subsidy quota for 1967/1968 equal to the amount of his previous year's delivery. On deliveries up to this level of SEQ, the Commission paid a subsidy of $1.21/cwt of industrial milk. Production over SEQ levels did not receive a subsidy during 1967-1969. However, starting in 1969/1970, a penalty for production beyond the SEQ allotment was imposed.

In the first half of the 1970s, the dairy industry experienced financial pressures. Both prices and average total costs (the latter as measured by the Alberta Agriculture Survey[1]) more than doubled during this time period. Notable events which occurred during this period were the introduction of formula pricing at the producer level for fluid milk, and the provincial entry into the national market-sharing program for industrial milk. Costs (particularly of feed) in 1973 and 1974 were rising at such a rapid pace that there were frequent requests to the PUB for public hearings in order to change producers' prices. The PUB adopted formula pricing of fluid milk in October 1974. The components of the index were measured each month. A new pricing order was issued any time a change of 38 cents per cwt in the producer price was indicated by the formula. This formula pricing system was still in effect in December 1979, although changes during 1980 are possible.

In 1972, Alberta joined the national market-sharing program for industrial milk. This plan replaced the earlier SEQ program. The market-sharing plan encompassed a market-sharing quota (MSQ) system for industrial milk and "excess" fluid milk. Under the market-sharing arrangement, each industrial producer received a market-sharing quota based on his deliveries in the year preceding entry into the plan or on his SEQ, if that was greater than his deliveries. For MSQ milk, each producer received a price related to the price support levels for butter, cheese and skim milk powder, plus a direct subsidy payment on shipments with his MSQ. Under this program there was also a system of levies to provide for export subsidies and to serve as over-quota penalties. Federal and provincial policies, programs and regulations will be examined further in Chapters III and IV.

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[1] The Production Economics Branch of Alberta Agriculture conducts a monthly survey of selected fluid milk producers, in order to provide an indication of costs and economic conditions in the production of fluid milk in Alberta for the ADCB and the PUB. This survey covers 60 to 70 fluid milk producers who are voluntary participants, i.e., they are not randomly selected. The major cost items covered in the survey are total average operating costs, which include such items as feed, machinery, buildings, interest, paid labour, depreciation and other miscellaneous costs. Average total production cost estimates of this survey are based on total operating costs, the value of family labour, and interest on capital. The value of family labour is calculated from hours worked times the wage rate in farming. The interest rate used in the survey is comparable to the rate on intermediate term investments, term deposits, or Canada Bonds. More information on these cost estimates are in: R. Susko, Economics of Milk Production in Alberta, Edmonton: A.D.A., Production Economics Branch, various issues.

CHAPTER III

FEDERAL POLICIES, PROGRAMS AND REGULATIONS IN THE DAIRY INDUSTRY

Introduction

The Canadian dairy industry appears to be the most regulated agricultural industry in Canada. The justifications given for this regulation have ranged from the desire to protect the dairy farmer from competition considered to be unfair to the perceived need for a stable supply of high quality dairy products to the consumer. Under the jurisdiction of the British North America Act, both the federal and provincial governments of Canada have authority over agriculture. The Canadian Dairy Commission (CDC) holds regulatory powers over the dairy industry under the authority of the federal government. The CDC's prime responsibility is over industrial milk which is used in the manufacturing of cheese, butter, skim milk powder and other manufacturing products. The Alberta Dairy Control Board (ADCB) and the Public Utilities Board (PUB) exercise regulatory powers over the Alberta fluid milk sector.

The ADCB's prime concern is with fluid milk production in Alberta while the PUB's responsibility is for the system of minimum pricing of fluid milk at farm, processing, and retail levels in the province.

The Canadian Dairy Commission

The Canadian Dairy Commission commenced operations on October 31, 1966 and became responsible for administering the federal government dairy policy and programs in April 1967. The objectives of the CDC, as laid down by the Dairy Commission Act are:

> "1. To provide efficient producers of milk and cream with the opportunity of obtaining a fair return for their labour and investment.

2. To provide consumers of dairy products with a continuous and adequate supply of dairy products of high quality."[1]

The Act empowers the Commission to:

"1. Purchase any dairy product and store, process or dispose of it in any way it desires.

2. Make payments to the producers of milk and cream on any basis it deems appropriate.

3. Investigate any matter relating to the production, processing or marketing of any dairy product.

4. Assist in the promotion of the use of dairy products.

5. Provide for the registration of producers.

6. Exercise control of interprovincial export and import movement of dairy products.

7. Control milk production through quota levies."[2]

The major activities of the CDC are setting support or purchase prices for selected dairy products (butter, cheese, and skim milk powder), making subsidy payments to producers and controlling milk production by means of MSQ. Associated activities involve setting of levies, export assistance, and international food aid activities. More minor activities include market promotion and research. The major activities are briefly outlined below.

Market Support and Purchase Programs for Industrial Products

Purchasing dairy products is an important part of the CDC's activities. The purpose of this purchase program is to maintain a stable internal market price for dairy products at levels higher than would apply in a competitive market. The Commission achieves stable prices by restricting dairy imports and purchasing major quantities of butter and skim milk powder (SMP) in the domestic market. One reason for these purchases is that the Commission performs a seasonal storage function for these products (particularly for butter) by buying butter and SMP in periods of surplus supply (summer) at support prices and reselling these supplies in periods of short supply (winter). Supplies that cannot be sold on the domestic market are sold on the world market at a considerable loss. The intention of the support program has generally been to encourage the production of sufficient milk to fulfill domestic requirements of butter and traditionally exports of cheddar cheese.[1] Since 1971, the CDC has not purchased cheddar cheese under the program since the market price remained above the support level.

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[1] Canadian Dairy Commission Act, S.C., 1966-67, C.34, 51.

[2] Ibid.

Market Share Quotas

Another major activity of the CDC is controlling industrial milk production by means of Market Share Quotas (MSQ). The MSQ program specifically includes milk from fluid milk shippers. This extension of the earlier "subsidy eligibility quota" program was developed because fluid milk shippers (operating under provincial jurisdiction) produced "surplus" fluid milk which flowed into the industrial milk market (regulated under federal authority), adding to a surplus of milk products in the industrial market. The MSQ program was intended to overcome this problem by making "surplus" fluid milk subject to federal control.[1]

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[1] M.M. Veeman and T.S. Veeman. "The Impact of Federal Dairy Policies and Provincial Milk Boards on Canadian Consumers." Paper prepared for the Canadian Consumer Council, April 1974 (Mimeo.), p. 33.

To administer certain features of the MSQ program, the Canadian Milk Supply Management Committee (CMSMC) was created in April 1975. This committee is composed of delegates from each provincial milk marketing board or commission; the organization of Dairy Farmers of Canada, and members of the CDC; who chair the bimonthly meetings. The CMSMC's responsibility is to estimate domestic and export requirements for industrial milk, advise the federal cabinet on the total amount of MSQ to issue, and decide how the total MSQ is to be allocated among the provinces. Table 3.1 shows the original MSQ allotment and how changes have occurred from 1975 to 1978.

Through its milk boards or commissions, each province is responsible for distributing its provincial MSQ allotment among provincial producers after it has received this from the CDC (by way of the CMSMC). On behalf of the CDC, these agencies also deduct the specified levies on deliveries "within MSQ", on deliveries "in excess of MSQ", and a fluid levy, and remit these levies monthly to the CDC. The levy deduction on deliveries "within MSQ" and the fluid levy are applied to defray the cost of surplus disposal of SMP. "Excess MSQ" levies are intended to discourage the production of milk over MSQ allotment levels. Table 3.2 indicates the amounts of these levies since 1974. Since 1976, the "excess MSQ" levies have been sufficiently high so that producers' average total cost of production is unlikely to be recovered on this "excess" milk.

---

[1] The MSQ program was instituted on December 1, 1970 with participation from Ontario and Quebec. Prince Edward Island entered the MSQ program on the same date in 1971. Alberta joined on April 1, 1972, and Saskatchewan and Manitoba on July 1, 1972. British Columbia entered on October 1, 1973. Nova Scotia and New Brunswick completed the participation on April 1, 1974.

TABLE 3.1

Market Sharing Quota Entitlement by Province (Million Pounds of Butterfat)

Province	Original Entitlement	April 1 1975	April 1 1976	April 1 1977	July 1 1978
Prince Edward Island	6.5	(7.0)	4.9	(6.8)	(6.8)
Nova Scotia	4.1	4.1	(4.1)	4.5	4.4
New Brunswick	4.5	4.5	(4.5)	4.9	4.8
Quebec	196.8	212.1	169.2	177.6	174.0
Ontario	148.8	137.7	111.4	116.0	113.7
Manitoba	18.1	(19.6)	13.9	14.4	14.2
Saskatchewan	14.7	(14.7)	--	9.2	9.4
Alberta	34.1	(36.0)	23.9	24.8	24.3
British Columbia	11.5	11.9	11.0	11.5	11.2
Canada	439.1	447.6	351.7	369.7	362.8

( ) Designated as "protected".

SOURCE: Canadian Dairy Commission, Annual Reports. Various Issues, 1975 to 1979/80.

TABLE 3.2

Levy Rates on "Within MSQ" Deliveries, "Over MSQ" Deliveries and "Fluid Levy" ($ per 100 pounds)

Year		"Within MSQ" Levy	"Over MSQ" Levy	"Fluid Levy"
1974	April 1	$0.15	$1.50	
1975	April 1	0.45	4.00	
	July 1	0.65	4.00	
1976	April 1	1.35	8.60	
1977	April 1	1.20	7.00	$0.25
1978	April 1	1.00	7.50	0.20
1979	April 1	1.00	7.50	0.20
	August 1	1.00	8.00	0.20

SOURCE: Statistics Canada, The Dairy Review. (Cat. No. 23-001.)

However, in Alberta the "excess MSQ" levies are not being applied because the province cannot fulfill its provincial MSQ entitlement.[1]

Under the initial market-sharing arrangement, each Alberta fluid milk producer was allotted MSQ which was:

> "1) equal to the pounds of milk marketed by the producer prorated to an annual equivalent less 115 percent of his fluid sales; or
>
> 2) equal to 15 percent of his fluid sales, whichever was the greater."[2]

Industrial producers were initially allotted MSQ based on their deliveries of milk during the previous year. Additional and more precise information on the application and regulation of MSQ is undertaken in The Dairy Board Act, O.C. 740/75, Government of Alberta, Alberta Regulation 169/75.

Direct Subsidy Payments

The CDC's other major activity is in administering direct subsidy payments to producers. This federal policy has consistently been in effect since the 1966-1967 dairy year.[3] Since the MSQ program has been in effect, this payment of direct subsidies to individual producers has been limited to the amount of MSQ the individual producer possesses. Currently (1979), the subsidy level is $2.66 per 100 pounds of MSQ milk.

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[1] If a province's provincial entitlement is not fulfilled, interprovincial adjustments of MSQ may be made by the CMSMC.

[2] The Alberta Milk Control Board. The Alberta Plan for Milk Market Sharing. Edmonton: Alberta Dept. of Agriculture. Pamphlet, no date.

[3] The major thrust of federal dairy policy before 1966 was through price support of dairy products, though direct subsidies were paid from time to time.

Table 3.3 illustrates direct subsidy payment levels on MSQ milk since 1965. In combination with MSQ, the direct subsidy is intended to increase producers' returns while restraining increases in production. While increasing producers' incomes, however, direct subsidies (and other support programs) can be expected to prolong inefficient resource allocation by retaining inefficient producers in production longer than without direct subsidies.

Pricing of Industrial Milk

Producer prices for industrial milk are, to some degree, administered provincially, but the level of these prices is largely affected by the activities of the CDC. The price of manufacturing milk is established on the basis of the price of butterfat and milk solids. With the establishment of "support prices" for butter and SMP, the CDC effectively establishes minimum market prices.

The setting of support prices can be described with the aid of Figure 3.1. From 100 pounds of raw milk, processing results in 4.2 pounds of butter and 8 pounds of SMP. When a change in support prices seems warranted, one question to be answered is how to distribute the change between butter and SMP. Many price combinations for these joint products are possible. Some examples of ways in which a specific "market price guarantee" for 100 pounds of industrial milk can be achieved are illustrated in Figure 3.1. The practice of setting support price for butter, SMP, and cheddar cheese has applied since April 1, 1968. Table 3.4 shows the support prices for butter, SMP, and cheddar cheese which have applied since April 1, 1968.

The general price structure of industrial milk is illustrated by Figure 3.2. Once a particular "target return" level is decided, some

TABLE 3.3

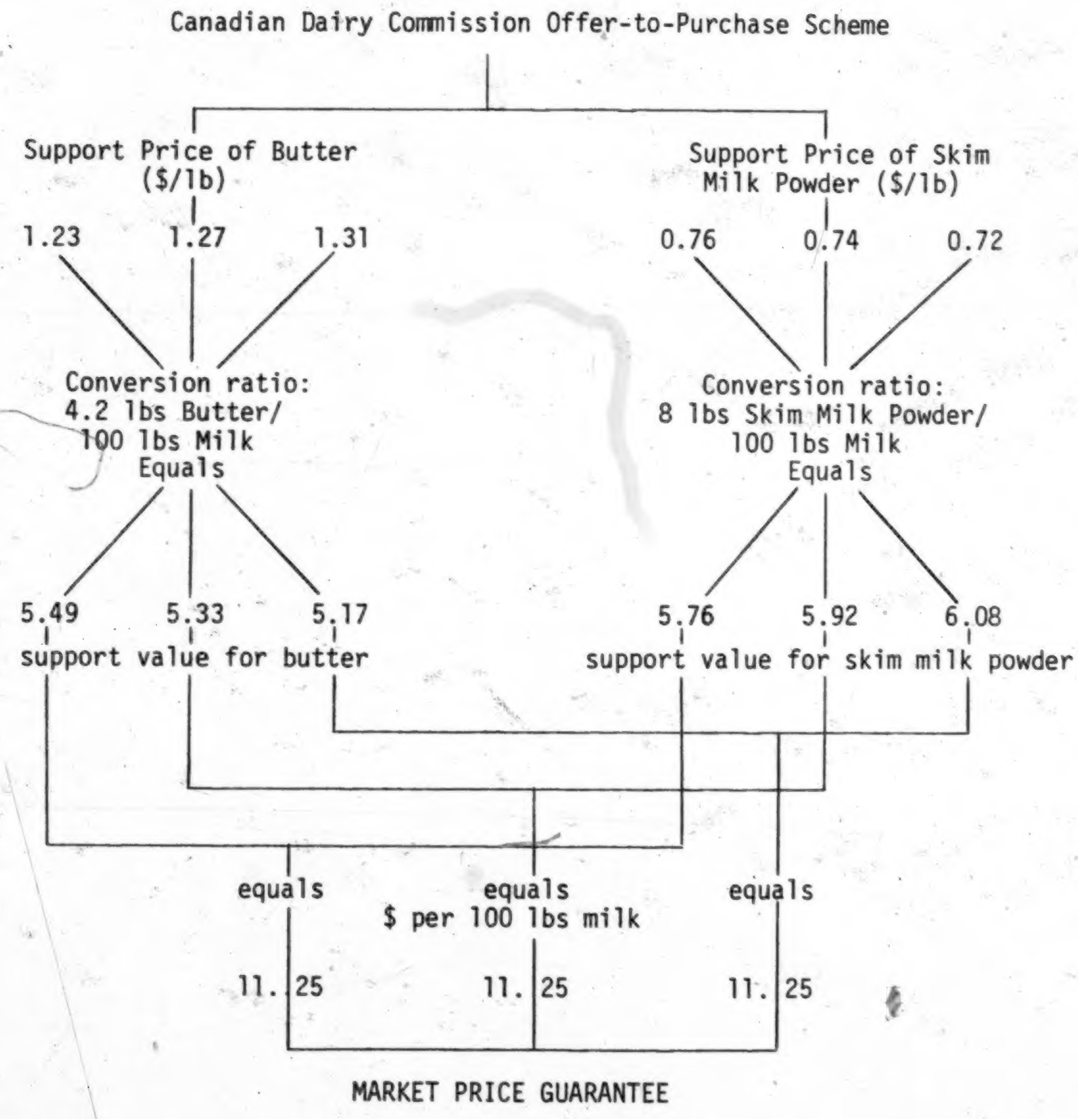
Direct Subsidy Payments on MSQ Milk
Since 1965 ($ per 100 lbs milk)

Dairy Year	Direct Subsidy Payment
1965-66	0.58
1966-67	0.85
1967-68	1.21
1968-69	1.31
1969-73	1.25
1973-74	1.45
1974-April 1	2.30
-June 1	2.56
1975-79	2.66

SOURCE: Canadian Dairy Commission, Annual Report, 1977/78 and Annual Report 1979/80.

FIGURE 3.1

Setting Support Prices for Butter
and Skim Milk Powder


Canadian Dairy Commission Offer-to-Purchase Scheme
Support Price of Butter ($/lb)
1.23
1.27
1.31
Support Price of Skim Milk Powder ($/lb)
0.76
0.74
0.72
Conversion ratio: 4.2 lbs Butter/ 100 lbs Milk Equals
Conversion ratio: 8 lbs Skim Milk Powder/ 100 lbs Milk Equals
5.49
5.33
5.17
support value for butter
5.76
5.92
6.08
support value for skim milk powder
equals
equals
$ per 100 lbs milk
equals
11.25
11.25
11.25
MARKET PRICE GUARANTEE

SOURCE: Derived from D. Peter Stonehouse, "Government Policies for the Canadian Dairy Industry," Canadian Farm Economics, Vol. 14, No. 1-2, 1979.

TABLE 3.4

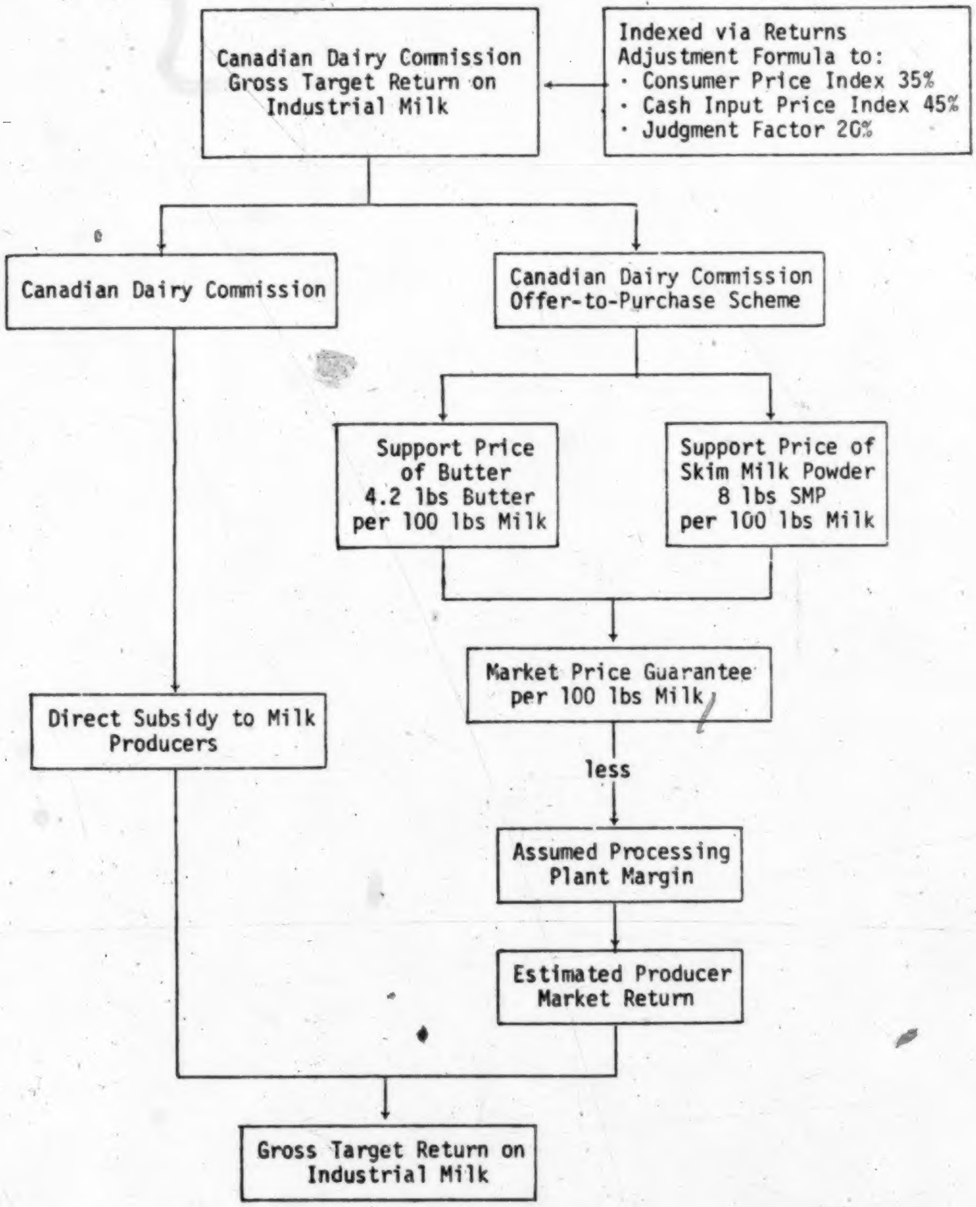
Federal Dairy Support Prices for Butter, Skim Milk Powder and Cheddar Cheese

Effective Date		Butter	Skim Milk Powder	Cheddar Cheese
		(Cents per pound of product)		
1968	April 1	63	20	38
	September 30	65	20	47
1971	February	65	24	47
	April 1	65	24	51
	August 16	68	26	51
1972	April 1	68	29	54
1973	April 1	71	35	54
	August 1	71	38	54
1974	April 1	77	50	60
	August 1	85	54	60
1975	January	90	59	60
	April 1	103	64	60
1976	April 1	108	68	60
1977	April 4	118	70	60
1978	January 1	122	72	60
	April 1	127	74	60
1979	April 1	137	81	60

SOURCES: 1) Statistics Canada, The Dairy Review, December 1979 (Cat. No. 23-001).
2) Canadian Dairy Commission, Annual Report, 1977/78.

FIGURE 3.2

Unit Returns-Setting Mechanism for Industrial Milk


Canadian Dairy Commission Gross Target Return on Industrial Milk
Indexed via Returns Adjustment Formula to:
· Consumer Price Index 35%
· Cash Input Price Index 45%
· Judgment Factor 20%
Canadian Dairy Commission
Canadian Dairy Commission Offer-to-Purchase Scheme
Support Price of Butter 4.2 lbs Butter per 100 lbs Milk
Support Price of Skim Milk Powder 8 lbs SMP per 100 lbs Milk
Market Price Guarantee per 100 lbs Milk
Direct Subsidy to Milk Producers
less
Assumed Processing Plant Margin
Estimated Producer Market Return
Gross Target Return on Industrial Milk

SOURCE: D. Peter Stonehouse, "Government Policies for the Canadian Dairy Industry," Canadian Farm Economics, Vol. 14, No. 1-2, 1979.

combination of direct subsidy and support price levels must be decided on to achieve the target return. In effect, this involves the decision of how to distribute the "target return" for producers between taxpayers (through direct subsidies) and consumers (through retail prices reflecting support prices). The government's "returns-setting" mechanism allows for a "reasonable" processing plant margin. The end result is a "gross target return" price on industrial milk. Subtracting all levies, a "net target return" is achieved. An example of these procedures is illustrated in Figures 3.3 and 3.4 which use 1978-79 values. For the 1978-79 dairy year, a gross target return of $12.42 per 100 pounds of milk was applied. The direct subsidy was maintained at $2.66. Support prices for butter and SMP were determined at $1.27 and $0.74 per 100 pounds of milk, yielding a market price guarantee of $11.25 per 100 pounds of milk. Subtracting the processing margin of $1.49, "producer market return" was $9.76 per 100 pounds of milk. Adding $2.66 per 100 pounds of milk, a direct subsidy achieved a "gross target price" of $12.42. Subtracting the SMP export levy of $1.20 gives the overall "net target return" of $11.22 per 100 pounds of milk.

"Target return prices" for industrial milk may vary within the dairy year. Since 1975, the "returns adjustment formula" has applied. This mechanism was designed to provide a more visible price setting mechanism.[1] The return adjustment formula is designed so that the base price[2] is adjusted in line with:

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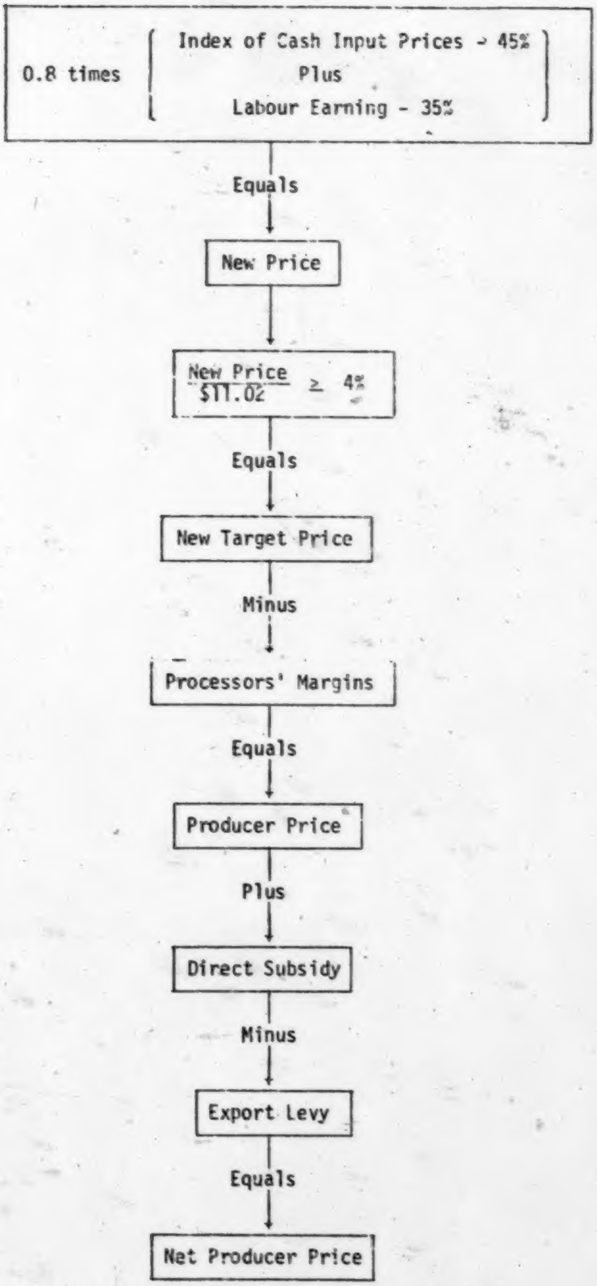
[1] Food Prices Review Board, Dairy Foods II: Policy. Information Canada, Ottawa, 1976, p. 12.

[2] In 1975, the base price was calculated as $11.02 per 100 pounds of milk.

FIGURE 3.3

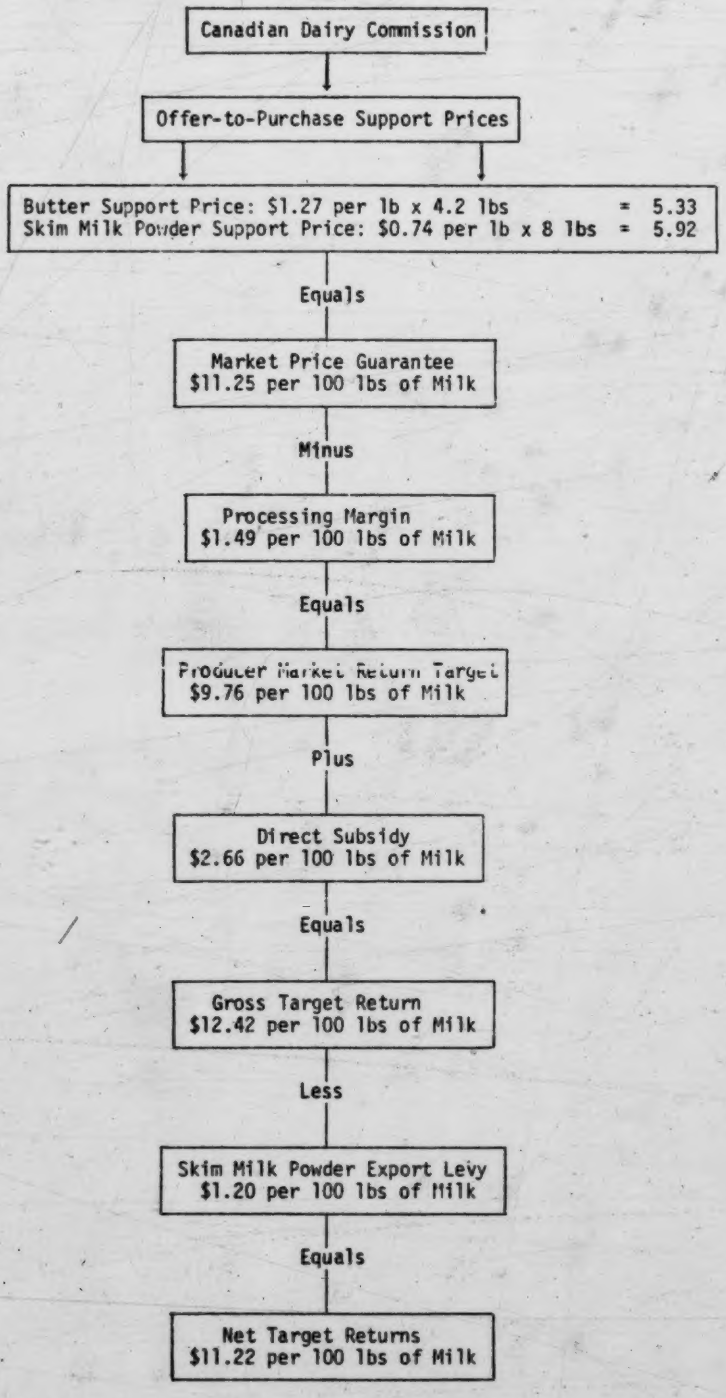
Formula Pricing for Industrial Milk


0.8 times
Index of Cash Input Prices - 45%
Plus
Labour Earning - 35%
Equals
New Price
New Price / $11.02 ≥ 4%
Equals
New Target Price
Minus
Processors' Margins
Equals
Producer Price
Plus
Direct Subsidy
Minus
Export Levy
Equals
Net Producer Price

SOURCES: 1) Canadian Dairy Commission.
2) Food Prices Review Board, Dairy Foods II: Policy, p. 13.

FIGURE 3.4

The Canadian Dairy Commission Support System for Industrial Milk Returns, 1978-79


Canadian Dairy Commission
Offer-to-Purchase Support Prices
Butter Support Price: $1.27 per lb x 4.2 lbs = 5.33
Skim Milk Powder Support Price: $0.74 per lb x 8 lbs = 5.92
Equals
Market Price Guarantee $11.25 per 100 lbs of Milk
Minus
Processing Margin $1.49 per 100 lbs of Milk
Equals
Producer Market Return Target $9.76 per 100 lbs of Milk
Plus
Direct Subsidy $2.66 per 100 lbs of Milk
Equals
Gross Target Return $12.42 per 100 lbs of Milk
Less
Skim Milk Powder Export Levy $1.20 per 100 lbs of Milk
Equals
Net Target Returns $11.22 per 100 lbs of Milk

SOURCES: 1) Adapted from Dairy Farms of Canada, Facts and Figures, 1977.
2) Canadian Dairy Commission.

1) an index of dairy cash input prices which is intended to evaluate costs in dairy production;
2) the consumer price index which is intended as a desired measure of "equitable" changes in the earnings of operator and family labour; and
3) a number of judgement factors.

A weight of 45 percent is given to the cash cost index, 35 percent to the "labour earnings" component and 20 percent to the judgement factors, for a total of 100 percent. The cash cost index is compiled of 12 weighted input indices. Table 3.5 shows these components and their weights. The "judgement factors" which are considered to have bearing on the formula are:

1) changes in dairy product stocks
2) changes in returns to dairy producers in other countries; and
3) changes in processing costs.[1]

The judgement factors have raised questions about such "target support pricing". The former Food Prices Review Board questioned the above judgement factors in the following statement:

> "Based on the limited information made public to date, "judgement factors" could move the price of manufacturing milk down by as much as 20 percent, or upwards by a totally unlimited amount. It is entirely possible that judgement factors could offset or dwarf any changes in the returns adjustment formula. "Judgement" then, as an open-ended factor applied over and above the formula, could well become the key determinant of manufacturing milk prices. This would mean that changes in cash costs and the CPI would really only have impact within a particular dairy year and each April 1, prices would be set on much the same ad hoc "politics sensitive" basis as in the past."[2]

---

[1] Canadian Dairy Commission, Annual Report 1977/78, p. 6.

[2] Food Prices Review Board, op. cit., p. 13.

TABLE 3.5

Index of Cash Input Prices

Corresponding Price Indices From Statistics Canada Farm Input Price Index	Percentage Weight
16 Percent Dairy Return	13.4
Artificial Insemination	0.6
Other Materials and Services Index	7.8
Machinery Repairs	3.1
Petroleum Products	2.0
Custom Work	0.4
Fertilizer	3.1
Seed	1.9
Building Repairs	1.4
Property Taxes	2.8
Electricity	1.9
Hired Farm Labour	6.6
Total Cash Cost Items	45.0

SOURCE: Canadian Dairy Commission, Annual Report, 1977/78.

Within any dairy year the formula is intended to be the basis of any changes in support prices and subsidy payments. Adjustments can occur at three month intervals, providing the formula demonstrates a change of 4 percent or more in relation to the prevailing target support price. Once a change of 4 percent has occurred, the support price for butter and SMP is subject to the above judgement factors.[1]

Even though the support price for butter, SMP, direct subsidies and skim milk powder export levies are specified at the federal level, the actual local price (as opposed to the "target price") is administered by individual provinces. The allowance for processors' margins and the actual level of these can vary between provinces. Different prices may, therefore, apply from one area to another. However, in dairy areas such as Alberta, processors' margins, at least as specified by provincial agencies, will usually coincide with the implicit margin used by the CDC.

The 1979-80 Federal Dairy Policy

The 1979-80 dairy program as announced by the Federal Minister of Agriculture in April 1979 was:

> "1) Starting this year, the dairy program will cover the period August 1 to July 31, with respect to allocations of quotas and all other elements of the program.
>
> 2) Canadian requirement for industrial milk for the above mentioned period are estimated as 98 million hundredweights plus a sleeve of 5.79 percent for a total MSQ of 103.7 million hundredweights.
>
> 3) The subsidy on industrial and cream shipments up to Canadian requirements remain at $2.66 per hundredweight of milk at 3.5 percent butterfat.
>
> 4) The in-quota levy will remain at $1.00 per hundredweight for milk at 3.5 percent butterfat. Any surplus from the 1978-79 export account will be credited to the 1979-80 export account.

---

[1] Canadian Dairy Commission, Annual Report, 1977/78, p. 6.

5) The levy on skim-off will remain at $1.00 per 3.5 pounds of skim-off butterfat equivalent to $0.20 per hundredweight of Class 1 milk.

6) The contingency levy will increase from $0.20 to $0.25 per hundredweight. This levy serves to cover production in the sleeve not needed to meet Canadian requirements. If the sleeve production is needed or if there is no production in the sleeve, the levy will be refunded with interest.

7) The over-quota levy will increase from $7.50 to $8.00 per hundredweight of industrial milk at 3.5 percent butterfat for cream producers.[1]

The following elements which deal with marketing and development of the industry will be in effect starting April 1, 1979, and continuing to March 31, 1980:

1) A budget of $4.8 million will be allocated to the promotion of dairy products subject to an equal participation by producers.

2) A budget of $1.7 million will be established for the research on new products and better marketing under the direction of the CDC and Agriculture Canada.

3) A budget of $10 million will be allocated to the Canadian International Development Agency for the purchases of skim milk powder for its Food Aid Program to underdeveloped countries.

4) The export funds will operate as in the past to finance the exports of products such as butter, SMP and cheese.

5) A budget of $18.9 million will be allocated to the CDC for transport costs, interest and storage in relation to the support price program for butter and SMP.

6) The cheese import quota will remain at 45 million pounds for 1979-80.

7) The federal contribution to the dairy program from April 1979 to March 31, 1980 will be $296 million compared to $305 million in 1978-79, $477 million in 1977-78 and $277 million in 1976-77."[2]

---

[1] In Alberta, over-quota levies are not collected because the province produces less than its market share and does not wish to discourage production.

[2] Agriculture Canada, "Dairy Program Announcement," News, D-17 (Ottawa: Agriculture Canada, April 1979).

CHAPTER IV

PROVINCIAL POLICIES, PROGRAMS AND REGULATIONS IN THE DAIRY INDUSTRY

Introduction

The responsibility for regulating the marketing of fluid milk in Alberta rests with the Alberta Dairy Control Board (ADCB). The responsibility over pricing of fluid milk at the producer, wholesale and retail levels is in the hands of the Public Utilities Board of Alberta (PUB). These two Boards have, therefore, major power over fluid milk production and marketing in Alberta.

The Alberta Dairy Control Board

The Alberta Dairy Control Board was formed on November 1, 1969 under the Alberta Milk Act. In 1972, the Milk Control Amendment Act amended the Milk Control Act to the current Dairy Board Act. Under this act, the ADCB is charged with the responsibility of establishing and enforcing regulations and orders with respect to production, processing, supplying, transportation, distribution and sales of milk in Alberta. The responsibility for setting minimum producer and consumer milk prices is under the PUB's jurisdiction.

The main purpose of the ADCB is to administer provincial and federal dairy policy. That is, this board administers the minimum producer, distributor and retail price levels for milk. The Board also administers the MSQ program, participates in the Canadian Milk Supply Management Committee, and determines policies regarding production quotas for industrial and fluid milk. The Board also appoints members to a policy committee which advises it on policies for the industry. In addition, a quota committee exists to advise the Board on quota policies and allotments.[1] The structure of the ADCB is described in Figure 4.1. Under the Dairy Control Act, the Lieutenant Governor in Council appoints the five members of the Dairy Control Board.

The Public Utilities Board of Alberta

Under the Dairy Act of 1972, the PUB has responsibility for setting minimum producer, distributor and retail prices for fluid milk. In the context of these responsibilities, the stated objective of the PUB is to influence the dairy industry in the "public interest". Before October 1974, this board had the difficult task of determining prices based on producer and consumer group representations. Since October 1974, formula pricing has been used; these procedures are discussed in greater detail later in the chapter.

The PUB appears to have a number of operational objectives in serving the public interest. These have been stated as:

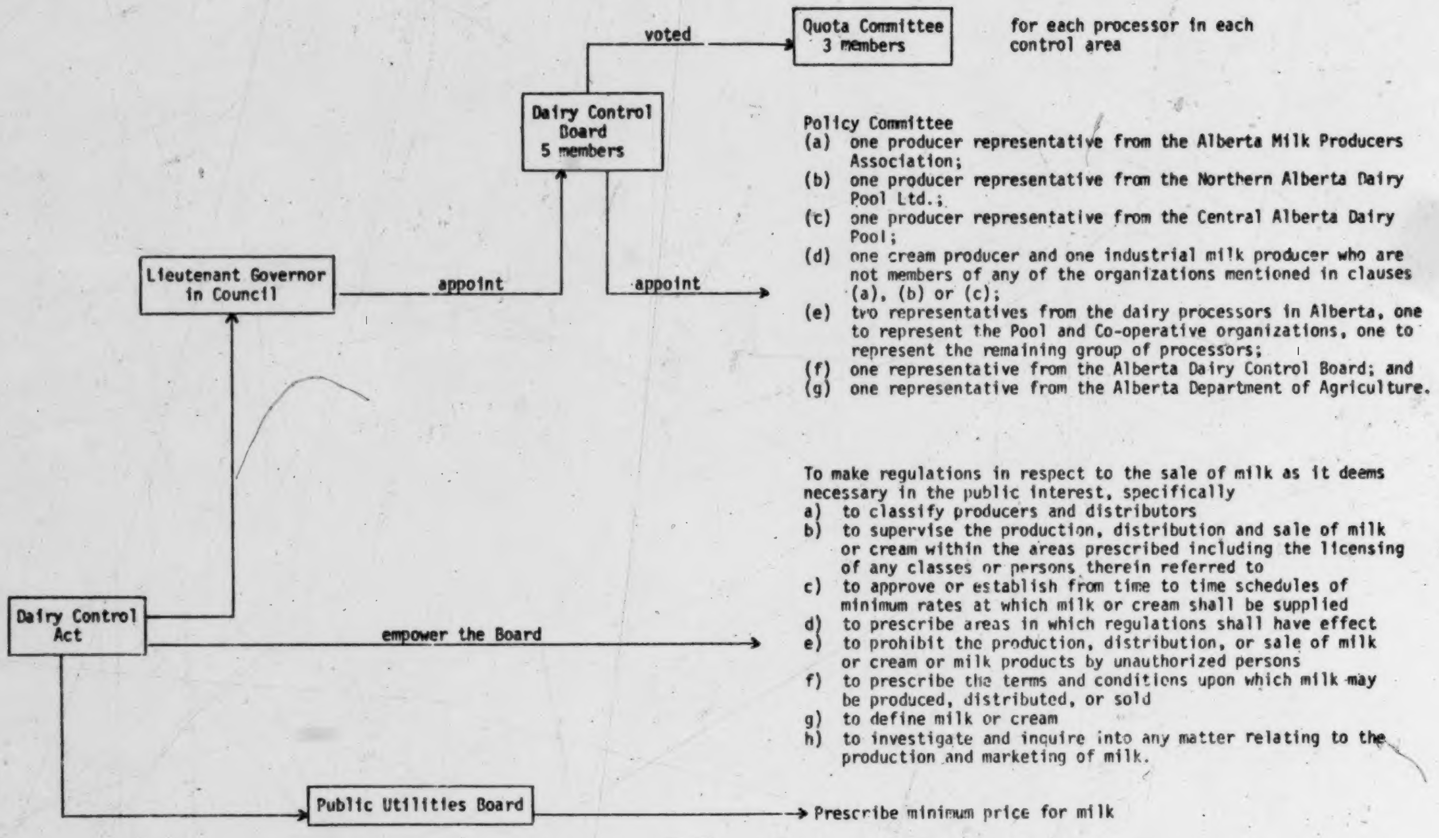
1) To ensure that producer prices are sufficiently high so that adequate supplies of milk are forthcoming.
2) To ensure that processors' and distributors' rates of return are sufficient to keep these phases of the industry viable and stable.
3) To ensure that competition between processors and distributors is not predatory.
4) To encourage firms in the industry to operate efficiently.

---

[1] In the early and mid 1970s, this committee played an important role in determining quota policies and allotments for each controlled area. Since then, the ADCB has undertaken more of the decision making with respect to quota policies. The committee's activities currently (1979) seem to be relatively perfunctory.

FIGURE 4.1

Structure of the Alberta Dairy Control Board



for each processor in each control area

Policy Committee
(a) one producer representative from the Alberta Milk Producers Association;
(b) one producer representative from the Northern Alberta Dairy Pool Ltd.;
(c) one producer representative from the Central Alberta Dairy Pool;
(d) one cream producer and one industrial milk producer who are not members of any of the organizations mentioned in clauses (a), (b) or (c);
(e) two representatives from the dairy processors in Alberta, one to represent the Pool and Co-operative organizations, one to represent the remaining group of processors;
(f) one representative from the Alberta Dairy Control Board; and
(g) one representative from the Alberta Department of Agriculture.

To make regulations in respect to the sale of milk as it deems necessary in the public interest, specifically
a) to classify producers and distributors
b) to supervise the production, distribution and sale of milk or cream within the areas prescribed including the licensing of any classes or persons therein referred to
c) to approve or establish from time to time schedules of minimum rates at which milk or cream shall be supplied
d) to prescribe areas in which regulations shall have effect
e) to prohibit the production, distribution, or sale of milk or cream or milk products by unauthorized persons
f) to prescribe the terms and conditions upon which milk may be produced, distributed, or sold
g) to define milk or cream
h) to investigate and inquire into any matter relating to the production and marketing of milk.

Prescribe minimum price for milk

SOURCE: B.C. Legislative Assembly, Select Standing Committee on Agriculture, Marketing Boards in Alberta and Marketing Orders in the Pacific Northwest, Victoria, Volume V. November 1978, p. 40.

5) To ensure that the price of milk to consumers is not excessive and generally to encourage conditions which will increase per capita consumption of milk.[1]

There are two points to consider about these operational objectives. First, priority may shift from time to time, due to changing circumstances. Second, the objectives are not always internally consistent. That is, two objectives may conflict with each other at certain times. For example, in order to maintain a stable processing sector, prices may be set at such a level that inefficiency occurs.

Fluid Milk Pricing in Alberta

The PUB sets minimum prices at the producer, wholesale, and retail levels. Producers' prices are the only prices set by formula. Wholesale and retail prices are established with reference to producer prices and set at a level intended to provide a "reasonable rate of return" to processors and distributors. Public hearings are usually held when processors and distributors give their case for price increases on the basis of increasing operating costs.[2]

The producers' pricing formula was designed by the Alberta Department of Agriculture. The formula has eight weighted components. Four of these have been described as "supply factors" and the other four have (very loosely) been described as "demand factors".[3] Components of the formula are outlined in Table 4.1. In essence, the first three items of the index in Table 4.1 are a "parity formula" intended to ensure that milk prices move in the same general direction and to the same extent as do general price and wage levels. The last four components in Table 4.1 are factors contributing to producers' costs of producing milk. These four components are an index of farm inputs, an index of farm wages, the price of alfalfa hay and the price of 16 percent dairy feed. The weights given to each component were similar, but not identical, to those used in similar formulae in British Columbia and Ontario (see Table 4.3). These last four components constitute a "cost formula" which is intended to reflect changes in the costs of producing fluid milk.[1]

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[1] R.W. Wright and R.L. Mansell, "The Regulation of Distributor Prices for Fluid Milk in Alberta." Paper prepared and presented for the Department of Consumer Affairs, Government of Alberta, at PUB public hearings in October 1975, p. 36-37.

[2] Ibid., p. 31-32.

[3] These components have been so described in a memo titled, "Pricing Milk by Formula," by the Production Economics Branch, Alberta Agriculture.

The introduction of formula pricing in Alberta was associated with the rapid change in economic conditions which occurred in the early 1970s. Uncertainties with respect to input costs (particularly feed) occurred at that time. Formula pricing bypassed the need for frequent public hearings by the PUB and provided automatic adjustment of producers' prices. The system is not without disadvantages, which are discussed later. The operation of formula pricing in British Columbia, Ontario and the United States,[2] helped implement formula pricing in Alberta.

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[1] In 1978, surveyed average total production costs were distributed approximately as follows: feed costs, 35.4 to 39.0 percent; labour costs, 16.9 to 21.0 percent; capital costs, 21.0 to 21.8 percent; and other costs, 22.3 to 22.6 percent. "Economics of Milk Production in Alberta," Production Economics Branch, Alberta Agriculture, Vol. 38, 1978, p. 9.

[2] For more information on formula pricing in the United States, see James W. Gruebele, "An Analysis of Production Cost Formulas as a Basis for Pricing Milk," Illinois Agricultural Economics, Vol. 16, No. 1, January, 1976.

TABLE 4.1

Components of the Alberta Fluid
Milk Pricing Formula

Components	Weight Percent
Wholesale Price Index (Canada)	15
Consumer Price Index (Canada)	15
Average Weekly Industrial Wage (Alberta)	10
Per Capita Consumption of Fluid Milk (Alberta)	10
Index of Farm Inputs (Western Canada)	10
Index of Farm Wages (Western Canada)	10
Price of Alfalfa Hay (Alberta)	15
Price of 16 percent Dairy Feed (Alberta)	15
	100

SOURCE: Production Economics Branch, Alberta Agriculture.

The Alberta formula pricing system operates in such a way that every month the weighted "composite index" (Table 4.1) is calculated. This index is multiplied by the base price[1] to yield the formula price estimate for that month. When a change of 43 cents[2] from the previous level of minimum producers' price is indicated, the PUB changes the minimum price to producers. Table 4.2 records the monthly formula price estimates and the actual minimum producers' price levels for fluid milk as set by the PUB, from August 1973 to December 1979.

The use of formula pricing has advantages as well as disadvantages. The potential advantages of formula pricing for fluid milk prices have been expressed as follows:

1) Price adjustments could be made automatically without holding public hearings.
2) The time lags between cost increases and price increases are shortened.
3) The formula allows both increases and decreases in producer prices.
4) The use of the formula allows greater stability in the fluid dairy industry which may result in:
    a) greater confidence when economic conditions are uncertain and thus greater ability to undertake

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[1] The "base price" for fluid milk was specified as $9.27/cwt of milk in August 1973. This level was determined from a 1973 dairy cost study conducted by the Production Economics Branch, Alberta Agriculture which provided for a 15 percent return on investment for fluid producers. The indices for the month of August 1973 were converted to 100, which was then equated to a base price of $9.27 per hundredweight.

[2] Originally (till February 1977), this required a change of 38 cents.

TABLE 4.2

The Estimated Formula Price and Minimum Producers' Price Levels for Fluid Milk in Alberta ($/cwt of milk)

	1974		1975		1976		1977		1978		1979	
	Estimated Formula Price	Minimum Producer Price	Estimated Formula Price	Minimum Producer Price	Estimated Formula Price	Minimum Producer Price	Estimated Formula Price	Minimum Producer Price	Estimated Formula Price	Minimum Producer Price	Estimated Formula Price	Minimum Producer Price
January			11.66		12.51		13.00	12.97	13.50	13.40	13.82	
February			11.67		12.35		12.88		13.66		14.00	13.83
March			11.77		12.52		13.01		13.71		14.10	
April		10.31	11.93		12.86	12.59	13.04		13.69		14.16	
May			11.82		12.77		12.99		13.54		14.29	14.26
June			11.79	11.83	12.62		13.14		13.62		14.47	
July			11.70		12.71		13.21		13.66		14.61	
August	11.31		11.67		12.64		13.16		13.77		14.70	14.69
September	11.41		12.08		12.70		13.19		13.74		14.95	
October	11.48		12.36		12.69		13.17		13.63		15.16	15.12
November	11.60	11.07	12.51		12.79		13.25		13.72		15.22	
December	11.67	11.45	12.35	12.21	12.92		13.28		13.79		15.40	

Notes: In August 1973, the estimated formula price was $9.27/cwt of fluid milk. The minimum producer price set at that time by the PUB was $8.80/cwt of fluid milk.

SOURCE: Alberta Public Utilities Board; and Production Economics Branch, Alberta Agriculture.

long term planning; and

b) increased modernization and efficiency.[1]

However, there are limitations and disadvantages associated with formula pricing. These have been outlined as follows:

1) It can discourage efficiency or decrease the rate of technological improvement because the formula may be too generous to producers due to:
    a) the base price being too high; and
    b) prices increasing more rapidly than costs.
2) It is difficult to establish an approximate base price.
3) The formula may not reflect changing conditions in the industry over the long run.
4) The formula may reduce the number of hearings, thus reducing debate on issues by interested parties.
5) The formula may be constructed so that gains in productivity accrue to producers rather than to both producers and consumers.
6) Seasonal or cyclical fluctuations may create a situation in which final prices of fluid milk may fluctuate in an erratic fashion; and
7) There may be problems with statistical inputs into the formula.[2]

---

[1] R.L. Mansell and R.W. Wright, op. cit., p. 20-21; and Broadwith, Hughes and Associates, "The Ontario Milk Marketing Board: An Economic Analysis," Government Regulation: Issues and Alternatives, 1978. Ontario Economic Council 1978, p. 76-77.

[2] Ibid., p. 22-33 and p. 76-77 respectively.

Because of the advantages and disadvantages, it is not possible to state whether formula pricing is desirable or whether it is undesirable. Rather, one can only reach a conclusion about a particular formula within the context of the objectives which the regulating agency is attempting to accomplish. In Alberta, Mansell and Wright have concluded that formula pricing is not consistent with the objectives of the PUB.[1]

Formula pricing for fluid milk is implemented not only in Alberta. British Columbia and Ontario also use formula pricing. Table 4.3 illustrates each province's use of components and relative weights.

Fluid Milk Quota Policy in Alberta

The Alberta Dairy Control Board administers the quota system for fluid milk in the province. The purpose of these quotas is to increase producers' incomes and to ensure an adequate daily supply of fluid milk in the province. In this pursuit, the province is divided into eight controlled areas. These are Calgary, Camrose, Crowsnest, Edmonton, Lethbridge, Medicine Hat, Ponoka, and Red Deer. The boundaries of these areas are defined in the Dairy Board Act. The numbers of producers and distributors in these areas are illustrated in Table 4.4. The amounts of fluid milk purchased by distributors in the areas are illustrated in Table 4.5. To further subdivide the controlled areas, each licensed processor and producer is allocated a quota in accordance with the anticipated demand for milk in that area. Demand for fluid milk is determined by expected consumption plus an additional "sleeve" of 10 percent. This "sleeve" of 10 percent is included as a contingency factor.

---

[1] R.L. Mansell and R.W. Wright, op. cit., p. 81.

TABLE 4.3

Components and Weights of the Alberta, Ontario and British Columbia Formulas

Components	Percentage Weights		
	Alberta	Ontario	B.C.
Wholesale Price Index	15	30	15
Consumer Price Index	15	--	15
Average Weekly Industrial Wage	10	15	20
Per Capita Consumption of Fluid Milk	10	25	--
Index of Farm Inputs	10	20	10
Index of Farm Wages	10	--	10
Price of Alfalfa Hay	15	--	20
Price of 16 percent Dairy Feed	15	10	10
	100	100	100

SOURCE: Alberta Dairy Control Board; Ontario Milk Marketing Board; and B.C. Milk Board.

TABLE 4.4

Number of Milk Producers and Distributors
at March 31, 1977, 1978, and 1979

	1979		1978		1977	
	Producers	Distributors	Producers	Distributors	Producers	Distributors
Calgary	375	3	343	3	315	3
Camrose	46	1	35	1	16	1
Crowsnest Pass	5	1	5	1	5	1
Edmonton	428	3	432	3	420	3
Lethbridge	37	2	37	2	30	2
Medicine Hat	10	2	11	2	11	2
Ponoka	4	1	4	1	4	1
Red Deer	-	2	-	2	-	2
Other Areas	78	10	77	10	80	10
Total	983	25	944	25	881	25

Note: In 1979, average daily shipment per fluid producer was 1,855 lbs. Average herd size was approximately 62 cows. Average production per cow was approximately 30 to 35 lbs of milk per day.

SOURCE: Alberta Dairy Control Board, Annual Report 1978.

TABLE 4.5

Fluid Milk Purchases by Distribution Plants
1974, 1975, 1976, 1977/78 and 1978/79 (lbs.)

Areas	1978/79	1977/78	1976	1975	1974
Southern	56,552,069	52,998,695	46,144,253	43,901,022	39,471,966
Calgary	271,282,159	240,261,792	188,436,709	186,410,092	162,597,881
Central	20,833,022	11,995,973	21,191,920	18,346,533	14,933,831
Edmonton	258,207,195	247,371,925	225,430,906	214,331,341	196,709,549
Total Controlled Areas	606,874,445	552,628,385	481,203,788	462,988,988	413,713,227
Other Areas[1]	58,587,412	58,603,432	58,886.577	63,861,305	48,516,360
TOTAL ALL AREAS	665,561,857	611,231,817	540,090,365	526,850,293	462,229,587

Notes: The "Southern Area" includes the Lethbridge, Medicine Hat, and Crowsnest central areas.
The "Central Area" includes the Camrose, Ponoka, and Red Deer areas.

[1] The shipment of 68,363,708 lbs of milk for 8 cheese plants and powder plants with graduated entrants is excluded.

SOURCE: Alberta Dairy Control Board, Annual Report 1978.

The ADCB, with the advice of the quota committee,[1] allocates daily fluid milk quotas to producers to meet processors' supply requirements. Processors' supply requirements are based on plant size and average daily sales during the previous year. Quota transfers between producers are permitted, but are tied to the plant where the quota-covered milk was previously delivered. In essence, producer quotas are tied to specific plants.

The authority to regulate quotas is derived from the Dairy Board Act. The more important regulations under that Act are that:

1) In January of each year the Dairy Board makes any necessary adjustments in daily quotas;
2) Transferring quota need not involve any part of the transferrer's herd;
3) No portion of the quota transferred may be less than 500 pounds and each cow sold with quota must be accompanied by a minimum of 40 pounds quota;
4) A producer may not ship to more than one plant;
5) A producer may not transfer quota that has been allotted by the Board until two years have expired from the date of allotment (allotted quota is quota given gratis by the Board);
6) All quota transfers are subject to approval of the ADCB.

Additional regulations are presented in Appendix N.

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[1] The quota committee consists of three members. The chairman of the committee is appointed by the ADCB, whereas the other two members are nominated respectively by processors and producers.

A major effect of the fluid milk quota program in Alberta is that it provides barriers to entry. A producer is restricted from entering the market unless an existing producer sells all or part of his fluid milk quota or unless he enters via the graduated entry program. The effects of the fluid milk quota program are discussed in more detail in the next chapter.

Graduated Entry Program

A method whereby the barriers to entry into the fluid market are reduced, is the graduated entry program. This program is designed for industrial or cream producers who have MSQ. Since industrial milk producers in the province are producing less than their MSQ allotment, MSQ is available from the ADCB.

A producer who enters the graduated entry program may receive up to 800 pounds of daily quota over a three year period.[1] In the first year, the producer receives 50 percent of his allotment and thereafter 25 percent each year for two years.

Some of the conditions upon entering the graduated program are that applicants must:

1) be a resident of Alberta;
2) have marketed milk for 12 months;
3) have marketed a daily average of at least 500 pounds of milk;
4) have farm premises which meet the specification of the Dairymen's Act;
5) have a bulk tank installed equivalent to 5 milkings;

---

[1] A level of production which was less than half that of the average Alberta fluid milk producer in 1979.

6) have an adequate production record in terms of the Dairymen's Act; and

7) be prepared to deliver his milk shipments to any plant that the Dairy Board may designate.

Additional regulations are presented in Appendix M.

The 1979 Alberta Dairy Policy

The stated policy regarding MSQ and the graduated entry program for 1979 is:

> "1) All existing milk and cream producers who wish to produce more than their present MSQ may do so and the Dairy Board will cover such shipments with MSQ from the provincial reserves.
>
> 2) Changes in the graduated entry program are as follows:
>   a) application can be made at any time (as opposed to applications being received prior to September 1 for entry January 1);
>   b) dates of entry into the program are the first of January, May and September;
>   c) any applicant must now have marketed milk for two months prior to entry date;
>   d) all applicants must not dispose of either fluid quota or quota previously allotted under the graduated entry program during the 24 month period prior to entry;
>   e) all applicants are required to ship their graduated entry quota for a full two years before such quota may be transferred, other than as set out in other regulations.[1]
>
> 3) All other policies will be the same as outlined in the Milk and Cream Quota Policies for the 1978-79 quota period."[2]

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[1] Alberta Agriculture, Dairy Herd Improvement Newsletter, Wetaskiwin, April 1979, p. 7-8.

[2] Alberta Dairy Control Board, Milk and Cream Quota Policies for the 1978-79 Quota Period. Pamphlet. Wetaskiwin, The Board, June 1978.

CHAPTER V

A REVIEW OF LITERATURE AND A THEORETICAL ANALYSIS OF MARKETING QUOTAS

Against the background of dairy policy, a theoretical analysis of fluid milk quotas in Alberta can now be undertaken. This chapter starts with a brief outline of the competitive market model. It then proceeds to a theoretical analysis of milk marketing under imperfect market conditions. A further discussion is concerned with the determinants and consequences of quota values. The chapter then discusses the structure of the fluid producing sector in Alberta. Finally, evidence on the levels of fluid quota values in other provinces is noted.

The Competitive Model

The dairy industry in Alberta does not approach the perfectly competitive model. That is not to say this model is not relevant to this study. Rather, the model can be employed as a "measuring stick" against which the structure, conduct and performance of the industry may be compared and evaluated.

According to Koch, the assumptions of a perfectly competitive model are:

> "1. A large number of sellers and buyers exist, no single one of which has a noticeable influence upon market price or quantity.
>
> 2. Each seller produces a homogeneous product that is undifferentiated and indistinguishable in any way from any rival seller's product.
>
> 3. Barriers to entry in the market in the long run are either very minimal or nonexistent.
>
> 4. No artificial restraints on supply, demand, or price exist in either the input or the output markets, and resources in general are perfectly mobile.
>
> 5. Each seller and buyer has complete and correct information about prices, quantities, costs, and demand in the market in which he participates.

6. Conditions of equilibrium:
    (a) marginal cost (MC) equals marginal revenue (MR);
    (b) price (P), average revenue (AR), and MR equals minimum average total unit cost (ATUC);
    (c) demand curve is perfectly elastic;
    (d) MC equals MR equals P equals AR equals minimum ATUC."[1]

In a perfectly competitive market for milk, both sellers (producers) and buyers (processors) are by definition price takers rather than price makers. The demand function that individual producers perceive is a horizontal line and is simultaneously the average revenue and marginal revenue curve. The price that producers observe is dictated by the interaction of market supply and demand schedules (Figure 5.1). The profit maximizing solution for individual producers is where $p = MR = MC$. From a societal point of view, this situation results in an efficient allocation of resources.

A Theoretical Analysis of Milk Marketing in an Imperfectly Competitive Framework

The structure of the dairy industry in Alberta is one of imperfect competition. It violates the assumption of the perfectly competitive model in many ways, including:

1) The processing industry is oligopolistic in structure. Regional concentration levels seem to be relatively high. Some degree of vertical integration (both forward and backward) exists;
2) The product is differentiated as fluid and manufacturing (industrial) milk and the prices of these products are controlled by different agencies;

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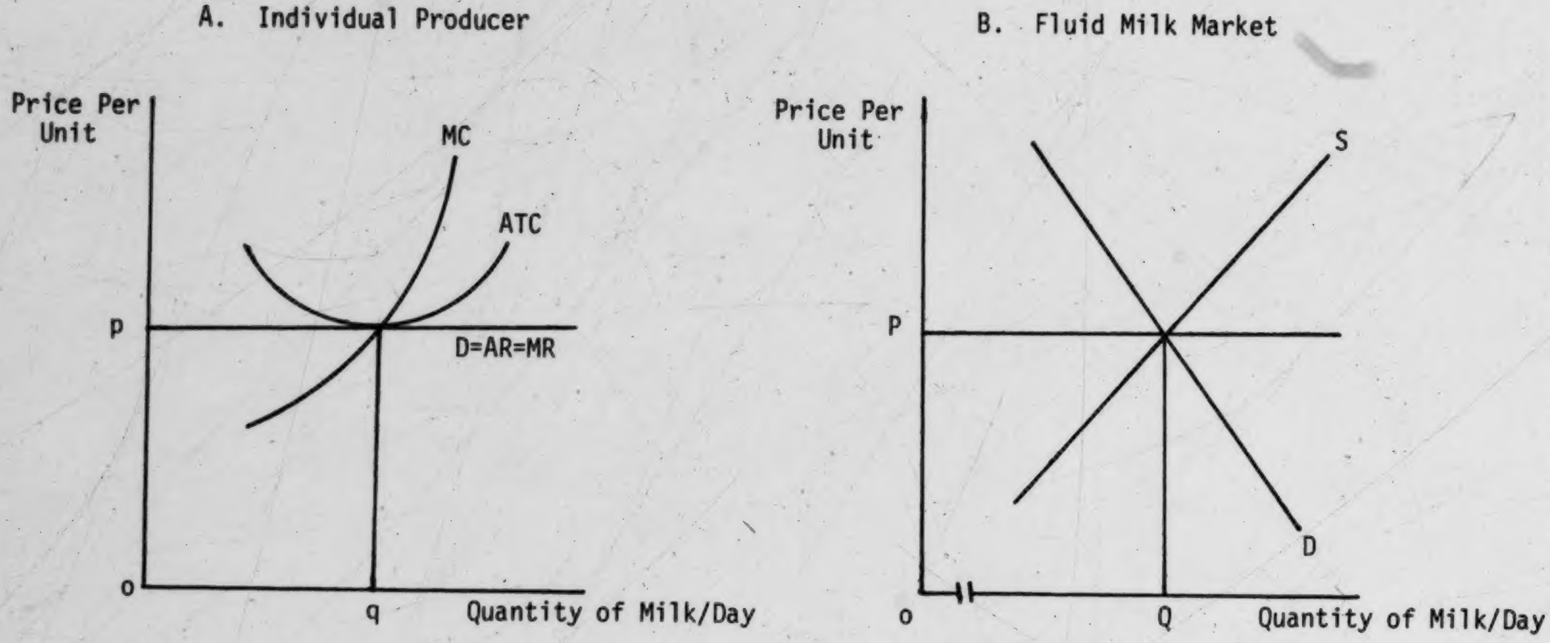
[1] James V. Koch, Industrial Organization and Prices. Englewood Cliffs, New Jersey: Prentice Hall, 1974, pp. 17-19.

FIGURE 5.1

Fluid Milk Pricing by an Individual Producer and for the Entire Market in a Perfectly Competitive Market



A. Individual Producer

B. Fluid Milk Market

Price Per Unit
MC
ATC
p
D=AR=MR
o
q
Quantity of Milk/Day
Price Per Unit
S
P
D
o
Q
Quantity of Milk/Day

3) The quantities sold in both markets are restrained by quota systems; and

4) The quota systems create barriers to entry.

The above features, to a great extent, are the result of government intervention in the industry. Milk boards are intended to ensure a "fair return" to producers. These boards have been given some degree of monopoly power by their legislation. The source of "monopoly power" for such boards is in their power to control milk supplies by means of market quotas.

For many years, many farmers have been concerned about their lack of bargaining power. Farmers' dissatisfaction with what many of them have perceived as imperfect market conduct by processors and purchasers, has led to political pressure for organized marketing to achieve bargaining power in the market place. Governments have been pressured to establish marketing boards as a necessary institutional mechanism for alleviating income problems. A feature of some marketing boards, in seeking to raise income levels of producers, has been to practice supply management using quota systems.

Quotas represent the right to produce and/or to market a commodity which, in this study, is fluid milk. According to Lane and MacGregor, "a quota can be viewed as a contract between a producer and a marketing agency which guarantees a market for a specified quantity of product - the price of the product may or may not be specified."[1] In the case of fluid milk in Alberta, the Alberta Dairy Control Board (ADCB) is the agency that determines and administers the terms and conditions of the quota. Once created, a quota represents a unique input to the production of milk. Although the total supply of quota available to producers is controlled by the ADCB, fluid milk quota may be sold and transferred between dairy producers. Transferability is, however, restricted to producers shipping to the same processing plant. The ADCB can approve transfers to producers outside that particular shipping area; this is unusual, but has occurred (mainly when a plant has closed or when producers wish to ship to a closer plant).

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[1] H.S. Lane and M.A. MacGregor, Quotas and Quota Values. Guelph: Ontario Agricultural College, University of Guelph, February 1979, p. 67.

Quota values are similar to "goodwill" values. Quota values, while related to excess earnings in the past, reflect expected excess earnings in the future. The purchase of a quota by an individual producer represents an investment. When quota is traded among producers, its price can provide an important measure of the anticipated economic benefits of entering the industry, and thus a measure of economic well-being of the industry.

With the above features in mind, a theoretical background of milk quotas in milk marketing is examined.

A Theoretical Background of Fluid Milk Quotas[1]

In this section, the imperfectly competitive model is analyzed in a comparative static framework. The consumer demand for fluid milk is relatively price-inelastic. That is, the quantity demanded changes by a smaller percentage than does price, all other things being equal. Marketing boards can, therefore, increase producers' total revenue by restricting production or market supplies through the use of quotas. By acting collectively, producers no longer are price takers. Given the characteristics of the demand function, the price levels that apply are those dictated by the fluid quota allotment for the entire market (Figure 5.2). The fluid quota levels of individual producers are generally based on their historical market shares.

In a perfectly competitive market, the interaction of supply and demand would result in the equilibrium price, P and quantity, Q (Figure 5.2B). With the quota program, market supplies are restricted to Q_1 and the price is increased to P_1. For the individual producer, instead of

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[1] The following theoretical analysis is based on earlier writings by:

Peter Arcus, "The Values of Milk Quotas in British Columbia: An Economic Analysis." Canadian Journal of Agricultural Economics, Vol. 26, No. 2 (June/July 1978), pp. 62-71.

R.R. Barichello, An Economic Analysis of the Dairy Farm Income Assurance Program. Vancouver: University of British Columbia, Department of Agricultural Economics, September 1977.

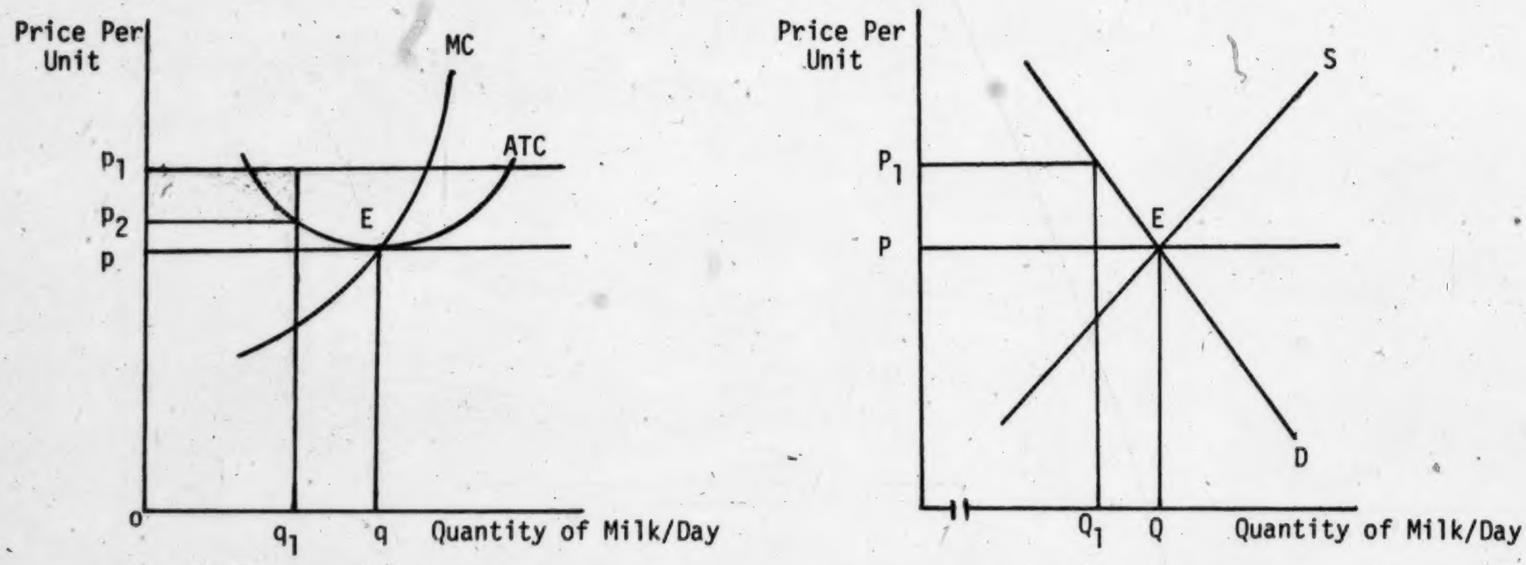
Hergert Grubel and Richard Schwindt. The Real Cost of the B.C. Milk Board: A Case Study in Canadian Agricultural Policy. Vancouver: The Fraser Institute, 1977.

Paul H. Hoepner, "Optimum Levels of Milk Production Under Marketing Quotas." Journal of Farm Economics, Vol. 46, No. 3(1964), pp. 567-579.

S.H. Lane and M.A. MacGregor, op. cit.

FIGURE 5.2

Fluid Milk Prices Under Quota Restrictions for an Individual Producer and for the Entire Market



A. Individual Producer

B. Fluid Milk Market

receiving price p for quantity q, supply restriction results in production of q_1, which is sold at price p_1. The resulting "above normal" profits the individual producer earns are (p_1-p_2) (q_1), the shaded area in Figure 5.2A. Figure 5.3 suggests that all producers earn "above normal" profits. This may not be the case since actual and opportunity cost levels may be different for individual producers. This point is examined more closely.

Figure 5.3 presents hypothetical cost curves for three different producers. The curves assume that the minimum average total cost of each is achieved at the level of output indicated by q. Each producer is also assumed to be producing his quota allotment of q. Figure 5.3 indicates that producer A is making greater profits than is B, as is true for B compared to C. Since short run expansion by each of these three producers is not feasible (all producers are producing at full capacity at the minimum of their ATC), producer C is the only one not earning "excess" profits at price p.

A new producer may enter by purchasing farm assets including quota from one of the existing producers. Since producer A is earning higher profits than the others, a potential entrant would be willing to pay a higher value for firm A than for firm B or C. The purchase value for firm B would exceed that for firm C. Thus, it can be reasoned that over time intergenerational transfers will lead to the average total cost curve of all production units in the industry rising to the level of p. In the long run, therefore, excess profits will be eliminated. This argument presumes that p does not change over time.

Figure 5.4 extends this analysis to the situation where individual firms are not operating at the minimum of their ATC. This figure is assumed to represent three of the many firms in the producing sector.

FIGURE 5.3

Hypothetical Cost Curves of Three Producers, Producing at Minimum Average Total Cost

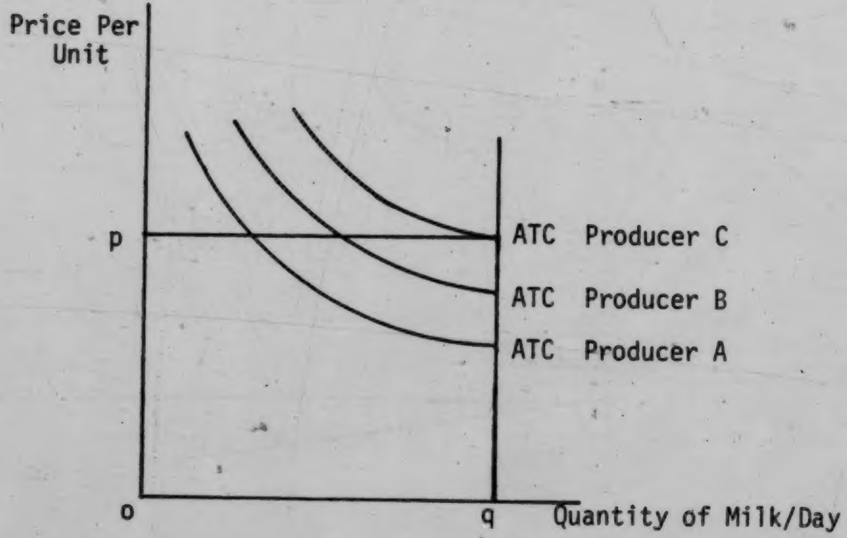
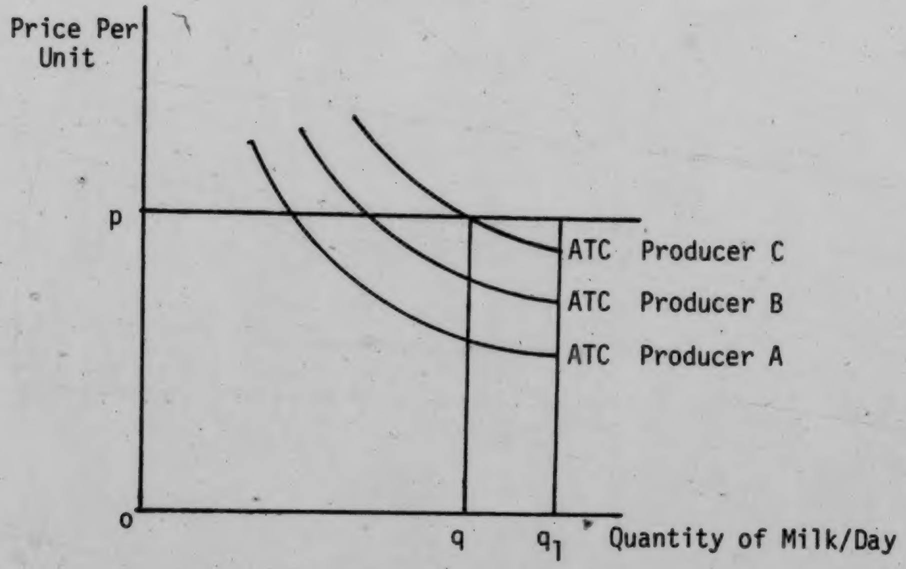


FIGURE 5.4

Different Cost Curves for Three Producers
Willing to Acquire Additional Fluid Milk Quota



In order to expand production, additional fluid quota must be acquired, that is, an existing producer must be willing to sell his quota allotment. The question arises as to who will likely purchase the additional quota.

Starting from an original position of pq in Figure 5.4, all three producers are willing to expand production to q_1 if additional quota is available. By purchasing additional quota, each of these producers would lower their unit costs and increase their gross and net revenue. However, since producer A has a lower average total cost curve than producer B or C, producer A earns greater profits. The value of additional quota, therefore, is higher to producer A than to the others, resulting in a higher price being offered by this producer for the additional quota. The same reasoning applies to producer B relative to producer C. Thus,

> "if quotas were made negotiable, the low cost producers would be prepared to pay more for quota than the high cost producers and hence would buy quota from the high cost producers, thus eliminating them from the industry. The net effect of making quota negotiable is to raise the cost of the low cost producers and lower the cost of the industry by eliminating the high cost firms."[1]

In the long run, low cost producers will replace high cost producers.

Theoretical Determinants of Quota Values

The purchase of fluid milk quotas represents an investment decision by producers. This section considers the costs and benefits to producers of purchasing fluid milk quota. If the market in fluid milk quota is competitive, the market values of these quotas will give a general indication of this sector's profitability and expectations.

It has been pointed out by Veeman and Veeman that:

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[1] H.S. Lane and M.A. MacGregor, op. cit., p. 78.

> "as long as ownership or use of fluid milk quota rights yields net returns in excess of other production alternatives, the anticipated stream of the increased net returns from ownership of quota rights will become capitalized into the present value of these rights."

Further,

> "quota values .... give valuable information on the net returns to producers who hold fluid milk quotas as compared to net returns from other production alternatives."[1]

The importance of opportunity cost in affecting quota values has also been amplified by Lane and MacGregor who argue that there are two major factors which affect fluid milk quota values. First,

> "the profitability of fluid milk production relative to industrial milk," and second
>
> "the profitability of fluid milk production relative to alternative enterprises, notably cash crops and beef."[2]

Lane and MacGregor examined Ontario agriculture and concluded that in the early 1970s, returns to industrial milk producers were low compared to those of fluid milk producers and that fluid milk quota values were relatively high. These authors also concluded that during the early 1970s, prices for corn and beef had been low compared to 1973 to 1975, and that the increases in corn and beef prices in the latter years have resulted in low fluid milk quota prices. These price levels are illustrated in Table 5.1. As of June 1976, free negotiability of fluid milk quota was suspended and all quota sales had to be made to the milk board at $16.00 per pound.

Veeman and Veeman further explain that provincial milk boards could use quota values to their advantage in pricing fluid milk. They

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[1] M.M. Veeman and T.S. Veeman, "The Impact of Federal Dairy Policies and Provincial Milk Boards on Canadian Consumers." Paper prepared for the Canadian Consumer Council, April 1974, pp. 52 and 62.

[2] S.H. Lane and M.A. MacGregor, op. cit., p. 47.

TABLE 5.1

Annual Average Prices of Fluid Milk Quotas, Corn, and Beef in Ontario, 1970 to 1978

Year	Average Price of Fluid Milk Quota	Average Price of Corn	Average Price of Beef
	($/lb of daily quota)	($/bushel)[1]	($/cwt)[2]
1970	21.57	1.37	30.40
1971	24.36	1.34	32.70
1972	17.22	1.39	35.61
1973	13.79	2.25	46.56
1974	6.68	3.17	49.37
1975	7.40	2.67	46.99
1976	19.01 (Jan.-May)	2.43	41.89
1976	16.00 (June-Dec.)	-	-
1977	16.00	2.01	44.50
1978	16.00	2.73	62.07

[1] No. 2 Yellow Corn, Chatham.

[2] A1 and A2 Steers over 1,000 lbs at Toronto Stockyards.

SOURCES:
1) Ontario Milk Marketing Board;
2) Canada Grains Council, Canadian Grains Industry, Statistical Handbook 79.
3) Statistics Canada, Coarse Grain Review, Catalogue No. 22-001.

state that,

> "if quota values are high and increasing, this provides a signal that administered price levels are higher than necessary, whereas very low and declining quota values indicate that an increase in administered price levels for fluid milk may be warranted. A high quota value may also be used by boards as a signal that increased opportunity for new producers into this market by graduated entry is warranted."[1]

These pressures appear to have been recognized at least to some degree by the provincial dairy board. For instance, in 1978 fluid quota values were relatively high. A great increase in graduated entry occurred in 1979.

In Ontario, similar events occurred between 1973 and 1976 (Table 5.3). In 1973 when quota prices were high, there were 762 producers who entered the program. In 1974 and 1975, low quota prices were associated with lower numbers of graduated entrants. In 1976, the reverse occurred.

Several studies of milk quota values have been undertaken with reference to the British Columbia dairy industry. Fluid milk quota values in British Columbia had reached (and in some cases exceeded) $150 per pound of daily quota, by the end of December 1979. This high level created concern expressed by economists such as Arcus, Barichello, Grubel and Schwindt, and members of the British Columbia Select Standing Committee on Agriculture (BCSSCA). These studies and reviews are outlined below.

According to Barichello, a prospective quota buyer is influenced by three main factors: first, his demand price for quota depends on the incremental net return that he would gain each year from owning the quota; second, the lifetime of the quota; and third, the rate of discount.[2]

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[1] M.M. Veeman and T.S. Veeman, op. cit., p. 63.

[2] R.R. Barichello, op. cit., p. 6.

TABLE 5.2

Average Fluid Quota Prices and Graduated Fluid Entrants, Alberta, 1975 to 1979

Year	Weighted Annual Average Fluid Quota Prices In Alberta	Number of Graduated Entrants
	($/lb of daily quota)	
1975	3.13	69
1976	15.51	54
1977	12.18	76
1978	23.53	140
1979	9.54	224

SOURCE: Calculated from ADCB records.

TABLE 5.3

Average Fluid Quota Prices and Graduated Fluid Entrants, Ontario, 1973 to 1976

Year	Average Annual Fluid Quota Prices In Ontario	Number of Graduated Entrants
	($/lb of daily quota)	
1973	13.79	762
1974	6.68	250
1975	7.40	133
1976	19.01 (Jan.-May) 16.00 (June-Dec.)	1,028

SOURCES: 1) S.H. Lane and M.A. MacGregor, "Quota and Quota Values." Guelph: Ontario Agricultural College, University of Guelph, February 1979, p. 46.

2) M.T. Sundstrom, "The Impact of Graduate Entrant Milk Producers on the Supply Pattern for Fluid Milk in Southern Ontario: 1968 to 1976." Ontario Geography, Vol. 1, No. 12 (1978), p. 13.

These features can be reviewed in an alternative framework:

> "the values of quotas reflect the extra revenue they bring to the holder relative to the extra costs incurred in holding the quota. When the benefits and costs continue for more than one year, then some form of present value discounting is required."[1]

These features can be interpreted with Figure 5.5. This figure represents the demand curve for fluid milk as DD and the perceived price of fluid milk as P_f. The quantity of fluid milk consumed is represented by Q_1. Any milk produced in excess of Q_1 will receive price P_m, the industrial milk price. The aggregate supply curves S_oS_o and S_1S_1 are associated with two different cost situations.

To give a safe margin in meeting fluid quota requirements, producers are allocated industrial milk quotas (MSQ) to cover "excess" production above their fluid quota (10 percent or more in British Columbia and 13 percent or more in Alberta). The extra gross revenue earned by producing an additional unit of industrial milk beyond the individual's fluid milk quota is, therefore, OP_m.

Barichello observed that between 1971 and 1975 in British Columbia, "excess" production by fluid producers was an average 29 percent of the quantity of fluid milk quota which was produced. This suggested to Barichello that the supply curve from 1971 to 1975 was S_oS_o, rather than S_1S_1 in Figure 5.5. Arcus assumed that the marginal cost (MC) of producing additional milk was below price P_m, and, therefore, the production of "excess" milk was profitable provided no major penalty applied to this production. However, because a penalty of between $1.50 and $4.00 per cwt applied, production of excess milk was not profitable.

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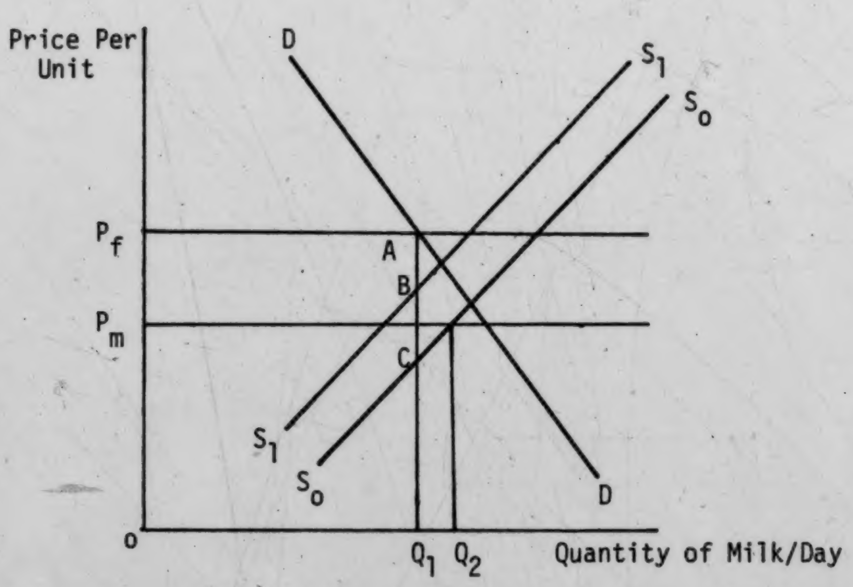
[1] P.L. Arcus, op. cit., pp. 64-66.

FIGURE 5.5

Aggregate Supply Of and Demand For Milk



Also, because the total amount of quota was allotted in both markets, expansion of individual producers could only occur if other producers wished to sell fluid milk quota. Since it was profitable to produce fluid and industrial milk if additional quota was available (since the supply curve is S_0S_0), producers bid fluid milk quota to where the perceived MR equals MC.

An additional feature of fluid quota values are their tax implications. Reports commissioned by the BCSSCA argue that federal taxation policy creates incentives to invest in quota since this is treated as a capital item for tax purposes. The benefits are stated as follows:

> "1. Quota can be written off or depreciated for tax purposes, thus increasing cash flow during the period when farmers are paying for quota. This effectively reduces the real (after tax) cost of quota. (The rate is 10 percent per annum on a declining balance on 50 percent of original purchase price.)
>
> 2. Interest paid to finance quota purchases is tax deductible.
>
> 3. Quota is treated similarly to a capital gain when sold and income averaging can be applied to reduce taxes in the year of sale."[1]

The above report concluded that tax benefits resulted in higher fluid quota values than would otherwise be the case, though the amount of the higher value could not be determined. This report concluded that tax benefits were greatest to farmers in high marginal tax brackets which would explain, to some extent, why expansion in the dairy industry between 1973 and 1978 was undertaken by the largest farms in British Columbia.

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[1] British Columbia Legislative Assembly, Select Standing Committee on Agriculture, Supply Management and Quota Values in Primary Agriculture. Phase II Research Report, December 1978, p. 57.

The process of determining fluid quota values has been described as follows:

> "In practice, the value of the quota is established through competition among potential dairy farmers who obtain the best possible information about the current and future profitability of selling milk at the official Board price and take into consideration the market rate of interest. Given these views about the likely profitability of holding the quota and their cost of borrowing capital, the potential dairy farmers offer a price just high enough so that after servicing of the loan, they earn something above the normal rate of return obtainable in another occupation and in other use of their equity capital. Competition among potential dairy farmers assures that at the market price for a quota, earnings above normal are small and tend to zero."[1]

Consequences of Quota Systems

Supply management (through supply restriction applied by quotas) has the potential for both beneficial and harmful effects. This section identifies and discusses possible detrimental effects of a quota system. To limit the subject matter, three effects that are generally recognized as major issues are discussed. In this section, the question of capitalization of quota values is discussed. In the next section, the questions of resource allocation and barriers to entry are discussed.

Discussing the detrimental effects of capitalization in a quota system requires some review of present value theory. Arcus states that:

> "time is obviously a factor in the value of the quota. If MR-MC is one dollar and it applies only for one day, then the maximum value of the quota is $1.00. If the difference lasts for a year or even several years, then the value of the right to receive this amount daily increases substantially ... The values of these expected future differences must be discounted, to allow for the cost, or opportunity cost, of the money used to purchase the additional quota."[2]

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[1] Herbert Grubel and Richard Schwindt, op. cit., p. 14.

[2] P.L. Arcus, op. cit., p. 68.

Quota prices, therefore, can be expressed as follows:

$$V = \sum_{i}^{N} \frac{(P_i - MC_i)}{(1 + r)^i}$$

where V = value of quota to producer

P_i = price of product in future time period

MC_i = marginal cost of production in period

r = opportunity cost of capital (including a risk factor)

i = the time period, i = i, . . . , N.[1]

A major problem with such analyses is in deciding the rate of discount (r) to be used. A younger farmer who has a longer planning horizon may use a lower discount rate and, thus, bid a higher price for quota than would a farmer with a shorter planning horizon. However, in such private investment decisions, as Miller and Nelson point out:

> "the discount factors for calculating the present values are [should be] based on the opportunity cost for capital, i.e., the return that could be earned by investing elsewhere with comparable risk. If, by investing in purchased quota, an alternative investment is foregone that would return 15 percent, the opportunity cost of the capital is 15 percent. Determining the cost of capital is largely a matter of judgement. As a starting point, however, it should not be considered lower than the cost of borrowed capital."[2]

However, producers are mindful of the fact that "the actions of his legislative representative can never be predicted with absolute certainty. He perhaps views the continuation of such a program [quotas] into perpetuity with some degree of skepticism and trepidation."[1] Therefore, the value of fluid quota tends to fall short of that calculated under the assumption that a present net income stream is certain and available in perpetuity.

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[1] British Columbia Legislative Assembly, Select Standing Committee on Agriculture, op. cit., p. 45.

[2] P.D. Miller and G.A. Nelson. Alternatives for Acquiring Additional Oregon Milk Market Quota. Corvallis: Agricultural Experiment Station, Oregon State University, Special Report 403, January 1974, p. 4.

In a competitive market, capitalization of net income streams can be considered a reward for efficient production or superior management and can provide an indication of the profitability of the industry.[2] In a market where supply is restricted by means of a quota program, capitalization reflects the higher incomes for owners who own that right to produce. As noted by Veeman:

> "Programmes involving supply restriction in order to increase the level of product price are programmes which involve the establishment and exertion of monopoly power in an effort to achieve monopoly profits. Since such a programme is established by limiting supplies forthcoming from individual producers through quota rights and since quota rights are required to gain access to the higher prices and the programme yields, these rights acquire a capital value. That is, as long as ownership of quota rights yields returns in excess of other production alternatives, the anticipated stream of the increased net returns from ownership of quota rights will become capitalized into the present value of such rights. The capitalized value of quota rights may be less obvious or less easily identifiable under some quota techniques than under others; however, it is an inevitable aspect of supply restriction schemes."[3]

Since fluid quotas have a value, quota applying marketing boards do confer benefits upon their members. New entrants to the market, however, must pay an amount for the fluid quota that reflects the expected future flow of benefits. Thus benefits of the capitalization of future income streams accrue to the owner-seller of fluid quota as a windfall capital gain. In the long run, therefore, as Figure 5.3 illustrates and earlier discussion indicated, "excess" profits of second generation quota holders are reduced if not eliminated. If normal returns are then deemed "inadequate", the marketing board may then increase product price to current producers to a level deemed "fair". Thus, fluid quota prices themselves may be used as a justification for product price increases.[1]

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[1] H.P. Hoepner, op. cit., pp. 569-571.

[2] British Columbia Legislative Assembly, Select Standing Commiteee on Agriculture, op. cit., p. 42.

[3] M.M. Veeman, "Alternative Techniques of Quota Regulation by Marketing Board Actions." Report of the Marketing Board Seminar, Occasional Series No. 3, Department of Agricultural Economics, University of Manitoba, pp. 61-62.

Size and Structure of the Fluid Milk Production Sector in Alberta

As is implicit in the preceding sections, supply management is likely to create the problem of restricting resource allocation. In a competitive market, resources are free to move to the most efficient uses and areas possible. Under supply management systems, this is not always possible. Because production is restricted, fixed resources may be used at less than optimum capacity which will contribute to inefficiency and higher costs of production.

In the province of Alberta, limitations on the transferability of fluid quota are applied. Fluid quota is sometimes attached to an immovable asset. In Alberta, this attachment is to processing plants. Fluid quota, thus, can only be traded among producers who deliver fluid milk to the same plant.

There is little, if any, information on the relationship between size and costs, that is, on economies of scale in the dairy industry in

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[1] Herbert Grubel and Richard Schwindt, op. cit., p. 17.

Alberta. However, one study in British Columbia suggests that in 1978, average total costs decreased as farm herd size increased to about 80 cows.[1] Some 60 to 80 milking cows can be managed by a farmer without requiring any major input of hired labour. Assuming an "average cow" produces 35 pounds of milk each day and assuming a milking herd of 60 cows at any one time gives a daily quota requirement (35 times 60) of 2,100 pounds of milk. Allowing 100 pounds for feeding, spillage and other uses, 2,000 pounds of milk daily is, therefore, assumed to be produced on a farm of "reasonable efficiency", with respect to size.

Using the above criteria, Table 5.4 assists in interpreting the likely implications of dairy farm size levels in Alberta. In the Edmonton area, 93 producers produce 2,000 or more pounds of milk daily, while 320 producers produce less than 2,000 pounds of milk daily. Some 77.5 percent of the producers appear to be operating at a scale which is less than optimum (2,000 pounds or less), whereas 22.5 percent of producers appear to be operating units of optimum size. In the Calgary area, 124 producers (33 percent) are producing at a scale which appears to be optimum, while 255 (67 percent) are producing at a scale which appears less than optimum. In Lethbridge, 30 producers (55 percent) are producing at an optimum level, however, 25 producers (45 percent) are not.

The assessment above suggests that the Lethbridge area contains the highest proportion of efficient size fluid milk producers. The large numbers of relatively small producers in Edmonton may be one of the factors why lower quota values are recorded in that area as compared to the rest

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[1] British Columbia Legislative Assembly, Select Standing Committee on Agriculture, op. cit., p. 62.

TABLE 5.4

Distribution of Established Fluid Milk Producers in Alberta, by Size of Daily Quota, December 1979

Quota Range	Edmonton Area	Calgary Area	Lethbridge Area	Other Areas
		(Number of Producers)		
0-500	26	68	5	127
500-1,000	86	63	5	116
1,001-1,500	143	73	5	38
1,501-2,000	65	51	10	15
2,001-2,500	49	42	6	15
2,501-3,000	14	18	9	5
3,001-3,500	10	23	4	3
3,501-4,000	8	15	2	1
4,001-4,500	2	8	4	4
4,501-5,000	4	6	0	-
5,000 +	6	12	5	3
TOTAL	413	379	55	327

SOURCE: Alberta Dairy Control Board.

of the province (Appendix A). Economic theory would suggest that fluid milk producing resources should shift out of the Edmonton area towards the Calgary-Lethbridge area. However, under current (1979) dairy policy, this will not likely happen due to the restrictions on fluid quota transfers.

An area of concern to some is that of barriers to entry. New entrants can only enter the fluid milk producing industry by purchasing fluid milk quota from existing producers or by the graduated entrance program. If a new producer enters the fluid market by purchasing quota, the costs of such purchase can be substantial. For example, a 2,000 pound fluid quota in Alberta in 1975 had total value of approximately $6,000 ($3 times 2,000 pounds) as compared to $50,000 ($25 times 2,000 pounds) in 1978. This can represent a substantial portion of farm investment.

Quota Values in Other Provinces

Quota values in Alberta and other provinces are illustrated in Table 5.5. This table compares fluid quota prices in the provinces of Alberta, British Columbia and Ontario. From 1971 to 1974, fluid milk quota prices in Alberta and Ontario decreased. This drop in prices appears to have been the result of two major factors: 1) the profitability of industrial milk relative to fluid milk; and 2) the profitability of alternative enterprises such as cash crops and beef relative to fluid milk.[1] In British Columbia the price of fluid milk quota ranged from $34 to $39 per pound over this earlier period.

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[1] S.H. Lane and M.A. MacGregor, op. cit., p. 47.

TABLE 5.5

Prices of Fluid Milk Quotas in Alberta, British Columbia and Ontario, 1971-1979

Year	Quarter	Alberta[1]	British Columbia	Ontario[2]
		($ per pound of daily quota)		
1971	I	Range from $8-$11		26.47
	II			24.21
	III		37.25	23.95
	IV		34.08	21.53
1972	I	Range from $3-$10	38.59	19.25
	II		39.12	17.50
	III		36.25	16.29
	IV		37.22	14.65
1973	I	Range from $2-$4	36.28	15.61
	II		37.77	16.19
	III		38.32	14.55
	IV		34.81	10.25
1974	I	Range from $2-$4	35.48	9.63
	II		38.63	7.39
	III		37.00	5.36
	IV		34.15	3.75
1975	I	2.34	37.59	4.25
	II	2.65	58.96	6.35
	III	4.72	64.70	8.01
	IV	2.60	70.67	12.29
1976	I	11.00	66.84	18.37
	II	12.43	82.42	16.00
	III	13.66	79.33	16.00
	IV	15.08	77.67	16.00
1977	I	12.63	83.00	16.00
	II	12.16	97.24	16.00
	III	12.80	n.a.	16.00
	IV	11.24	n.a.	16.00
1978	I	17.52	n.a.	16.00
	II	22.22	n.a.	16.00
	III	22.36	n.a.	16.00
	IV	28.25	n.a.	16.00
1979	I	16.49	n.a.	16.00
	II	8.37	n.a.	16.00
	III	9.19	n.a.	16.00
	IV	6.25	n.a.	16.00

[1] Data for the years 1971 to 1974 are from C.F. Wulff.

[2] As of the second quarter of 1976, the Ontario Milk Marketing Board specified fluid quota prices at $16.00 per pound.

SOURCES:
1) R. Barichello, An Economic Analysis of the Dairy Farm Income Assurance Programme;
2) Broadwith, Hughes and Associates, The Ontario Milk Marketing Board: An Economic Analysis;
3) C.F. Wulff, "Regulations of the Dairy Industry in Alberta," Business 599 Research Paper, Faculty of Business Administration and Commerce, University of Alberta, March 1977; and
4) Calculations from ADCB records.

In 1975, fluid quota prices increased substantially in British Columbia and Ontario. The dramatic increase in British Columbia in 1975 is thought to be a direct consequence of the Dairy Income Assurance program (DIA)[1] in that province and the federal MSQ program. Payments under DIA increased current and expected profitability of fluid milk production. This DIA payment apparently became capitalized into the fluid quota price.[2] In Ontario the price of quota increased to the first quarter of 1976. After this date, all fluid milk quotas for sale had to be sold to the milk board and the administrated price of $16 per pound was applied. This action was taken to prevent further escalation in quota prices. These changes were thought to have been generated by producers attempting to offset major cutbacks in MSQ (see Table 3.1).

In 1979, fluid milk quota prices in Alberta decreased. This decrease may be explained by the substantial increase in costs which applied in that year (see "supply index", Appendix B). In British Columbia, however, some individual quota sales in 1979 exceeded $150.00 per pound. In Ontario fluid quota prices officially remained at $16.00 per pound in that year. In March 1980, the Ontario Milk Marketing Board lifted the trading restrictions on fluid and industrial milk quotas. Dairy officials expected subsequent fluid milk quota prices to exceed the previous level of $16.00 per pound.

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[1] Under DIA, fluid milk producers received a subsidy equal to the difference between the "cost of production" and market price. When the price of milk exceeds average total costs, producers pay one-third of the difference into the fund. During periods when costs exceed price, the money needed to pay producers is raised in equal proportions by: 1) payment from the provincial government's general revenues; 2) increases in retail prices to consumers; and 3) cash contributions by producers (to a maximum of 30 cents per cwt). Producers, in effect, are then receiving two-thirds of the difference between the cost and the price of milk.

[2] R.R. Barichello, op. cit., pp. 6-7.

CHAPTER VI

METHODOLOGY AND MODELS USED IN THE STUDY

In this chapter, the methodology and models used are discussed. The data used, their sources, and their limitations are outlined. Problems encountered during the study and the method of correcting for these are noted throughout the chapter. The procedures for testing the results are discussed at the end of the chapter.

Method of Data Collection

Data collected in this study were compiled into quarterly averages. The time period for which data were collected was from the fourth quarter of 1974 until the last quarter of 1979. The data used in the study are: 1) Alberta fluid milk quota values; 2) the weighted average of A1 and A2 steer prices at Calgary and Edmonton; 3) the "composite" index and its components in the Alberta milk pricing formula; and 4) the difference between fluid milk and industrial milk prices.

Alberta fluid milk quota values were obtained from the ADCB. It was necessary to collect these from board offices in the three centers of Wetaskiwin, Calgary and Lethbridge. These data cover quota transfers from all regions in Alberta except for the Peace River area. Fluid milk quota values were obtained from the written correspondence the ADCB has with producers who transferred fluid milk quota. The values at which these fluid milk quota transfers occur are recorded in Appendix A. Average prices for A1 and A2 steers at Calgary and Edmonton were collected from a secondary source, the weekly Canada Livestock and Meat Trade Report, published by Market Information Service, Agriculture Canada. Weekly average A1 and A2 steer prices (for 1,000 pounds plus) at the Edmonton and Calgary public stockyards were used to calculate the average quarterly prices. These prices are presented in Appendix A.

The data comprising the "composite" index and its components were collected and compiled by the Production Economics Branch, Alberta Agriculture. As outlined in Chapter IV, the statistical indices of these components were computed from various sources. For this study, the monthly indices were converted into quarterly averages. The milk consumption index was not available and was estimated for the fourth quarter of 1974 to the third quarter of 1975 as fluid milk sales as a percentage of total sales.[1] These indices are presented in Appendix B.

The difference between fluid milk and industrial milk price levels was considered to be a factor of importance to the study. This difference was derived from the weekly publication by Agriculture Canada, Dairy Market Report. Fluid milk was classified as Class I milk. Industrial milk prices were taken to be the average of Class II and Class III milk price levels. The differences between the fluid and industrial milk price levels were calculated on a quarterly basis, and are given in Appendix A.

Limitations of the Data

The data collected on fluid milk quota values had statistical weaknesses which are explained below. When analysing Alberta fluid quota values as in this study, discretion was used in interpreting the results because of these weaknesses in the data.

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[1] The source of these data was The Dairy Review, Statistics Canada, Cat. No. 23-001. The estimation for November 1974 was as follows: Of total milk production, 40 percent was for fluid sales, 48 percent was for manufactured use and 12 percent was for farm use. Since farm use did not contribute to total sales, it was not used in the calculation. Thus, fluid sales amounted to 45.5 percent of total sales (40/88 = 45.5). Adjusting for the base of 43.03 gave a component of 105.74 (45.5/43.03 x 100 = 105.74). The weight attached to this component was 10 percent. The "milk consumption" index, therefore, was 10.57 (105.74 x 0.1 = 10.57). The calculations were done for every month until the fourth quarter of 1975. A quarterly average was then determined.

Fluid milk quota values are recorded by the ADCB when the board assists in advertising and administering the sale of fluid milk quota. The information on transfers which was used in this study includes only those transfers of fluid milk quota which were not transferred with other assets. Problems in determining quota values arise when fluid milk quota are sold together with other assets; for example, cows and fluid milk quota can be sold together and this makes it difficult to distinguish market value for the cows and for the fluid milk quota. A further limitation of the data is that they apply to only some of the quota transfers in the province. Many producers sometimes sell fluid milk quota with other assets and without the ADCB's assistance, thus the values recorded by the ADCB for fluid milk quota may not be representative. Another limitation of the quota value data is that there are no observations for some months. The data of this study must, therefore, be interpreted with caution.

A further problem of this section of the analysis is the relatively short period of time covered by the investigation. The relatively small number of observations limits the statistical analysis and may lead to the likelihood of errors being greater than if a larger number of quarterly observations were involved. The length of time over which the statistical analysis was performed was limited by the availability of data on some of the proposed exploratory variables. As a result, the empirical investigation and its interpretation must be more cautious than would have been the case with a tighter data base which covered a longer period.

The Model

A general model is proposed to explain the level of and variations in fluid milk quota prices. Based on this general model, seven single estimating equations are applied. These are tested in both linear and (natural) logarithmic formulations. These models are hypothesised to explain variations in fluid milk quota values in the Edmonton milkshed and also variations in quota values in the province of Alberta. The coefficients of the estimating equations are estimated using ordinary least squares procedures. The models are tested on the price and cost data in both deflated and nominal form. The deflator used in the study is the consumer price index.

The seven single estimating equations are based on a general model in which the dependent variable reflects fluid quota values alternatively in the Edmonton milkshed and in the province of Alberta. The general model in linear form is as follows:

$$Q_t = a + b\ X_{1_{t-1}} + \dots + i\ X_{11_{t-1}} + VS_t + WD_{t-1} + u_t$$

The general model in logarithmic form is:

$$\ln Q_t = \ln a + b \ln X_{1_{t-1}} + \dots + i \ln X_{11_{t-1}} + V \ln S_t + W \ln D_{t-1} + \ln u_t$$

The specific models to follow take on the form as expressed above. For simplification, the models in this chapter are expressed in their linear form. The logarithmic equations for the specific models are presented in Appendix E. In the next chapter, both the linear and log results are given.

The seven models to follow are:

Model 1.

$$Q_t = a_1 + b_1\ X_{1_{t-1}} + V_1 S_t + W_1\ D_{t-1} + u_t$$

where: Q_t = average weighted fluid quota values in Alberta and, alternatively, in the Edmonton milkshed;

$X_{1_{t-1}}$ = "composite" index of the Alberta fluid milk pricing formula;

S_t = average weighted A1 and A2 steer prices in Edmonton and Calgary; and

D_{t-1} = fluid-industrial milk price difference in Alberta.

Model 2.

$$Q_t = a_2 + b_2 X_{2_{t-1}} + c_2 X_{3_{t-1}} + V_2 S_t + W_2 D_{t-1} + u_t$$

where: $X_{2_{t-1}}$ = the sub-index of the first four components of the "composite" index ("demand" index);

$X_{3_{t-1}}$ = the last four components (the "supply" sub-index) of the "composite" index; and

Q_t, S_t, and D_t are as defined above.

Model 3.

$$Q_t = a_3 + b_3 X_{2_{t-1}} + V_3 S_t + W_3 D_{t-1} + u_t$$

where: Q_t, $X_{2_{t-1}}$, S_t, and D_{t-1} are as defined above.

Model 4.

$$Q_t = a_4 + b_4 X_{3_{t-1}} + V_4 S_t + W_4 D_{t-1} + u_t$$

where: Q_t, $X_{3_{t-1}}$, S_t, and D_{t-1} are as defined above.

Model 5.

$$Q_t = a_5 + b_5 X_{8_{t-1}} + c_5 X_{9_{t-1}} + d_5 X_{10_{t-1}} + e_5 X_{11_{t-1}} + u_t$$

where: $X_{8_{t-1}}$ = farm input index from the Alberta fluid milk pricing formula;

$X_{9_{t-1}}$ = farm wages index from the Alberta fluid milk pricing formula;

$X_{10_{t-1}}$ = price index of 16 percent dairy feed from the Alberta fluid milk pricing formula;

$X_{11_{t-1}}$ = price index of alfalfa hay from the Alberta fluid milk pricing formula; and

Q_t = as defined above.

Model 6.

$$Q_t = a_6 + b_6 X_{4_{t-1}} + c_6 X_{5_{t-1}} + d_6 X_{6_{t-1}} + e_6 X_{7_{t-1}} + u_t$$

where: $X_{4_{t-1}}$ = consumer price index from the Alberta fluid milk pricing formula;

$X_{5_{t-1}}$ = wholesale price index from the Alberta fluid milk pricing formula;

$X_{6_{t-1}}$ = average weekly industrial wages from the Alberta fluid milk pricing formula;

$X_{7_{t-1}}$ = per capita consumption of fluid milk from the Alberta fluid milk pricing formula; and

Q_t = as defined above.

Model 6 as outlined here was applied to nominal rather than to deflated data. Variable X_4(CPI) was then excluded and the other variables were deflated by CPI in retesting this equation.

Model 7.

$$Q_t = a_7 + b_7 X_{8_{t-1}} + c_7 X_{9_{t-1}} + d_7 X_{10_{t-1}} + e_7 X_{11_{t-1}} + V_7 S_t + W_7 D_{t-1} + u_t$$

where: Q_t, $X_{8_{t-1}}$, $X_{9_{t-1}}$, $X_{10_{t-1}}$, S_t, and D_{t-1} are as defined above.

In the above models, which are regressed both on nominal and deflated data, one expects that as fluid milk prices rise, fluid milk quota values will do likewise. Since fluid milk prices are determined by the "composite" index, one expects that as the index increases, fluid quota values will respond similarly. If the index decreases, fluid milk quota values are also expected to decrease.

The average price of steers in the model gives an indication of gross returns from an alternative enterprise to fluid milk production. As steer prices decrease, producers may either exit from that industry and enter the dairy industry, or place less emphasis on the "dairy beef" by-product of their dairying activities. These activities would exert additional demand on fluid milk quotas and create upward pressure on quota values. The opposite affect may also be expected to happen when steer prices increase. The inclusion of the fluid-industrial milk price difference is based on the assumption that if industrial milk is the same price or only marginally below the price of fluid milk, fluid milk quotas would be worthless as long as industrial milk could be obtained at no cost. If industrial milk is not free or if the product price difference is large, this is likely to lead to greater demand for fluid milk quota (if gross returns from fluid milk are greater), leading to an upward movement on fluid quota values. The "supply" and "demand" indices are components of the "composite" index. Since the "supply" index reflects production costs, one assumes that as costs increase, profit decreases, resulting in less incentive to purchase fluid milk quota. The so-called "demand" index does not relate to production costs, but is rather a "parity" component which primarily reflects the general movement of prices and wages in the economy. As such, one assumes that as the index increases, so may the price of fluid milk and fluid milk quota providing that production costs increase less rapidly. The opposite situation may also happen. The variables X_4, X_5, X_6, and X_7 in the model are the sub-components of the "demand" index and their inconclusion, therefore, involves the same assumptions as above. It is of interest to include these four variables to assist in determining whether and which of them are significant in determining fluid quota values. Variables X_8, X_9, X_{10}, and X_{11} are the sub-components of the "supply" index. These variables reflect production costs and, therefore, are expected to influence fluid milk quota values by an inverse relationship.

Model 8.

Model 8 is a correlation matrix for the "composite" index and its eight components. The correlation coefficients are arrayed as follows:

$$\begin{array}{lccccccc}
 & X_{1_t} & X_{4_t} & \cdot & \cdot & \cdot & \cdot & X_{11_t} \\
X_{1_t} & \cdot & & & & & & \\
X_{4_t} & \cdot & & & & & & \\
 & \cdot & & & & & & \\
\cdot & & & & & & & \\
\cdot & \cdot & & & & & & \\
\cdot & & & & & & & \\
X_{11_t} & X_{1_t} & X_{4_t} & \cdot & \cdot & \cdot & \cdot & X_{11_t}
\end{array}$$

where X_{1_t}, X_{4_t}, . . . X_{11_t} are the variables (now not lagged) previously defined.

A correlation coefficient of 1 is taken to indicate perfect unison in variation of the relevant two indices and a coefficient of zero indicates no relationship between indices. A high correlation coefficient among variables may indicate the same relative movements amongst variables.

If that is the case, certain variables could be eliminated from the formula. By eliminating some highly correlated variables, others might be reweighted to more accurately reflect the economic condition of the dairy producing industry.

The Procedure for Testing the Results

The selected variables are proposed to explain variation in fluid milk quota values for both the Edmonton milkshed and for the wider region of Alberta. The models are tested on time series data. The coefficients of both the linear and logarithmic forms of the models are estimated by ordinary least squares using the Time Series Package (TSP), an econometric computer program. The models are run on data in both nominal terms and deflated terms, using CPI as the deflator. The F-values and t-statistics are used to test the significance of the regression equations and the individual coefficients, respectively. The coefficient of determination, R^2, which measures the amount of variation explained by the independent variables, is reported for all equations. The Durbin-Watson statistic (D.W.) is used to test for evidence of autocorrelation. Where autocorrelation is evident, the Cochrane-Orcutt Iterative Technique (COIT) is used to correct the estimates. This procedure uses OLSQ to calculate a RHO of sufficient magnitude to remove autocorrelation. The result is a transformed equation yielding a parameter value for the original intercept and all the slope parameters. The primary difficulty with this procedure is that there is no guarantee that the final estimate of RHO will be the "optimal" estimate, because the iterative technique may lead to a local rather than a global minimum. Thus, caution should be taken when interpreting the transformed results using the COIT. In addition, the significance levels for the coefficients are set at the 0.01, 0.05, and 0.10 levels.

CHAPTER VII

ANALYTICAL RESULTS

In this chapter, the results of the econometric analysis of fluid milk quota values in the Edmonton milkshed and in the province of Alberta are presented. This time series analysis covers the period from 1975 to 1979. The preceding chapter outlined the models used in the analysis. The estimated coefficients presented in this chapter were obtained by applying the least squares method of regression analysis. The models were formulated in both linear and natural logarithmic. They were tested on price and cost data which were in both nominal and real terms. In this chapter, only results of the deflated models are presented. Results using nominal data are in Appendix F to Appendix L.

The criteria used in judging the various models are:

1) whether or not the estimated coefficients are statistically significant;
2) whether or not autocorrelation as measured by the Durbin-Watson statistic is present;
3) to what degree the coefficient of determination (R^2) measures the power of the model; and
4) whether or not the estimated coefficients carry the expected sign.

Results of Models 1 to 8

Results of Model 1.

Model 1 expresses the average fluid milk quota prices in Alberta and in Edmonton as a function of the "composite" index (lagged one quarter), the average of A1 and A2 steer prices in Calgary and Edmonton, and the fluid-industrial milk price difference in Alberta (lagged one quarter).

The results are presented in Table 7.1 and Appendix F.

In Table 7.1, the estimated coefficients of steer prices (V_1) and the fluid-industrial price difference (W_1) are significant in both the linear and logarithmic forms of the model for both Edmonton and Alberta. The expected sign for steer prices (W_1) is as expected, but the sign for the fluid-industrial milk price difference (W_1) is not. The negative sign on W_1 indicates an inverse relationship of this variable with fluid milk quota values for both Edmonton and for Alberta. The variation explained by the three variables in this model ranges from 44 to 54 percent. The F-values of the estimated equations indicate that the relationships postulated are significant at the 0.01 percent level of significance. The test for serial correlation is inconclusive in all equations.

In Appendix F, the results of this model, when estimated on nominal data, are presented. Serial correlation is evident and, therefore, the Cochrane-Orcutt Iterative Technique (COIT) is used to correct for this. While the COIT is designed to produce reliable estimates of the regression coefficients, it deals with partial differences in the variables rather than with absolute amounts. Therefore, in interpreting the results in Appendix F, the transformation involved in the COIT must be borne in mind. As Appendix F indicates, in the logarithmic function for Edmonton, both the estimated coefficients of steer prices (V_1) and the fluid-industrial milk price difference (W_1) are significant at the 0.05 and 0.10 levels, respectively, in the Edmonton area equation. In the linear form of this model, only the estimated coefficient of steer prices (V_1) is significant for Edmonton. In the cases where fluid quota values for Alberta are the dependent variables, all estimated coefficients are insignificant using the COIT.

TABLE 7.1

Results of Model 1 on Deflated Data

Area	Model Form	Estimated Coefficients						
		a_1	b_1	V_1	W_1	R^2	D.W.	F-Value
		Intercept	"Composite" Index	Steer Prices	Milk Price Difference			
Alberta	Logarithmic	10.894 (0.490)	-0.417 (0.073)	-2.759*** (-3.761)	-3.667** (-2.781)	0.54	1.41^+	243.93
	Linear	70.818* (1.801)	-0.499 (-0.635)	-4.565*** (-3.041)	-6.596* (-1.908)	0.44	1.05^+	82.705
Edmonton	Logarithmic	-3.437 (-0.158)	2.753 (0.491)	-2.743*** (-3.814)	-2.290* (-1.772)	0.51	1.24^+	203.05
	Linear	10.138 (0.374)	0.474 (0.876)	-4.002*** (-3.870)	-5.237** (-2.20)	0.54	1.24^+	112.16

Notes: t-values are in parentheses
***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

The above results suggest that steer prices are important in determining fluid quota values. The results suggest that when steer prices are relatively low, producers may increase herd size and fluid milk quota because gross returns are greater in producing fluid milk than in raising beef. The estimated coefficients of the price difference between fluid and industrial milk suggest that this variable is also important in determining fluid quota values. The relationship is inverse when the model is tested on deflated data, and positive when the model is tested on nominal data, suggesting that producers may think of these differences in absolute terms rather than in real terms.

Results of Model 2.

In Model 2, average fluid milk quota prices in Alberta and, alternatively, in Edmonton, are postulated to be a function of the so-called "demand" index (lagged one quarter), "supply" index (lagged one quarter), the average of A1 and A2 steer prices in Calgary and Edmonton, and the fluid-industrial milk price difference in Alberta. The results are presented in Table 7.2 and in Appendix G.

Table 7.2 indicates that the estimated coefficient of steer prices (V_2) is significant at the 0.01 level in all equations. All other estimated coefficients are insignificant. The sign for steer prices (V_2) is as expected. The variation explained by the four independent variables ranges from 0.50 to 0.60. The F-values for the estimated equations are significant at the 0.01 level. The evidence on autocorrelation is inconclusive for all four equations.

In Appendix G, the results from testing the model on nominal data show that autocorrelation may be present. Using COIT, the results indicate that the estimated coefficients of steer prices (V_2) and the difference in

TABLE 7.2

Results of Model 2 on Deflated Data

Area	Model Form	Estimated Coefficients							
		a_2	b_2	c_2	V_2	W_2	R^2	D.W.	F-Value
		Intercept	"Demand" Index	"Supply" Index	Steer Prices	Milk Price Difference			
Alberta	Logarithmic	11.492 (0.569)	2.581 (0.796)	-3.794 (-1.065)	-2.521*** (-3.421)	-1.536 (-0.804)	0.60	1.25^+	209.03
	Linear	58.375 (1.555)	0.145 (0.328)	-0.702 (-1.424)	-4.310*** (-2.919)	-1.648 (-0.340)	0.50	0.933^+	70.64
Edmonton	Logarithmic	-3.277 (-0.161)	3.522 (1.080)	-1.307 (-0.365)	-2.535*** (-3.419)	-0.671 (-0.349)	0.55	1.18^+	165.00
	Linear	8.311 (0.305)	0.331 (1.020)	-0.082 (-0.228)	-3.909*** (-3.648)	-3.578 (-1.018)	0.55	1.23^+	85.91

Notes: t-values are in parentheses

***The estimated coefficients are significant at the 0.01 level

**The estimated coefficients are significant at the 0.05 level

*The estimated coefficients are significant at the 0.10 level

++The hypothesis of no serial correlation is accepted at the 0.01 level

+Inconclusive test for serial correlation

fluid-industrial milk prices (W_2) are significant at the 0.05 and 0.01 levels respectively, in the logarithmic function for Edmonton. In the linear function for Edmonton, only the estimated coefficients for steer prices (V_2) is significant at the 0.10 level. In the equation for Alberta, the estimated coefficient for the "demand" index (b_2) is significant in the logarithmic function at the 0.05 level. The F-values for the estimated equations are significant at the 0.01 level.

The above results again indicate that average steer prices are important in determining fluid quota values. This may suggest that at least some producers may be beef producers as well as dairy producers.

Results of Model 3.

Model 3 postulates that the average fluid milk quota price in Alberta and in Edmonton are functions of the "demand" index (lagged one quarter), average A1 and A2 steer prices, and the fluid-industrial milk price difference in Alberta (lagged one quarter). The results are presented in Table 7.3 and Appendix H.

In Table 7.3, the estimated coefficient of average A1 and A2 steer prices (V_3) is significant at the 0.01 level, except in the case of the linear equation for Alberta, where the coefficient for average steer prices (V_3) is significant at the 0.05 level. The estimated coefficient of the fluid-industrial milk price difference (W_3) is significant at the 0.01 and 0.05 levels respectively, in the logarithmic and linear functions for the Alberta area. Again, contrary to expectations, the estimates associated with fluid-industrial milk price difference (W_3) carry a negative sign. The estimated coefficient for this variable (W_3) in the equation for Edmonton is not significant. The coefficients of determination range from 0.44 to 0.57. Autocorrelation is inconclusive for the

TABLE 7.3

Results of Model 3 on Deflated Data

Area	Model Form	Estimated Coefficients						
		a_3	b_3	V_3	W_3	R^2	D.W.	F-Value
		Intercept	"Demand" Index	Steer Prices	Milk Price Difference			
Alberta	Logarithmic	-4.237 (-0.306)	3.156 (0.984)	-2.497*** (-3.376)	-3.204*** (-2.927)	0.57	1.27^+	258.85
	Linear	28.646 (0.890)	0.272 (0.603)	-4.078** (-2.693)	-7.245** (-2.484)	0.44	0.91^+	82.49
Edmonton	Logarithmic	-8.696 (-0.645)	3.720 (1.190)	-2.527*** (-3.505)	-1.246 (-1.168)	0.54	1.18^+	218.03
	Linear	11.766 (0.536)	0.316 (1.026)	-3.936*** (-3.810)	(-2.927) (-1.471)	0.55	1.23^+	114.13

Notes: t-values are in parentheses
***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

above results.

The results from testing the Model 3 on nominal data in Appendix H reveal that autocorrelation is present in all equations. COIT results disclose that the estimated coefficients in the logarithmic function for steer prices (V_3) and the fluid-industrial price spread (W_3) are significant at the 0.05 and 0.01 levels respectively, for the Edmonton area. The linear equation for Edmonton shows only steer prices (V_3) being significant at the 0.10 level. The F-values for this model tested on both real and nominal data are significant.

Results of Model 4.

In Model 4, average fluid milk quota values in Alberta and in Edmonton are postulated as a function of the "supply" index (lagged one quarter), average of A1 and A2 steer prices, and the fluid-industrial milk price difference (lagged one quarter). The results are given in Table 7.4 and Appendix I.

Table 7.4 shows that the estimated coefficient of average A1 and A2 steer prices (V_4) is significant at the 0.01 level for all equations. The sign of the estimated coefficient is as expected. All other coefficients are insignificant. The coefficient of determination ranges from 0.50 to 0.58 for the model. The tests for autocorrelation are inconclusive in this model.

Model 4 results, from using nominal data (Appendix I), are similar to those from Model 3 (Appendix H). That is, autocorrelation is present in all equations and, therefore, the COIT is used. For the Edmonton area, both the estimated coefficients of steer prices (V_4) and fluid-industrial price spread (W_4) are significant at the 0.10 level in the logarithmic function. In the linear function, only the estimated coefficient of the

TABLE 7.4

Results of Model 4 on Deflated Data

Area	Model Form	Estimated Coefficients						
		a_4	b_4	V_4	W_4	R^2	D.W.	F-Value
		Intercept	"Supply" Index	Steer Prices	Milk Price Difference			
Alberta	Logarithmic	24.200* (1.975)	-4.268 (-1.228)	-2.723*** (-3.982)	-1.746 (-0.934)	0.58	1.35+	267.23
	Linear	69.140*** (3.910)	-0.734 (-1.563)	-4.450*** (-3.240)	(-1.807) (-0.386)	0.50	0.96+	93.48
Edmonton	Logarithmic	14.066 (1.122)	-1.953 (-0.549)	-2.811*** (-4.017)	-0.959 (-0.501)	0.51	1.30+	203.83
	Linear	32.626** (2.467)	-0.093 (-0.027)	-4.225*** (-4.114)	-3.937 (-1.125)	0.52	1.31+	106.85

Notes: t-values are in parentheses
***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

fluid-industrial price spread (W_4) is significant at the 0.10 level. The R^2's for both functions are 0.73 and 0.70 respectively, and the expected sign of the significant coefficients are as expected.

The results from Models 1 to 4 indicate that average steer prices are an important variable in determining fluid quota values in both Edmonton and the province of Alberta. The estimated coefficient of the deflated fluid-industrial milk difference variable is more significant in the Alberta equations than in the Edmonton equations. This variation may perhaps be due to less than optimum size farms being apparently more prevalent in the Edmonton region than in the southerly areas of the province.

Results of Model 5.

In Model 5, average fluid milk quota values in Alberta and in Edmonton are postulated as functions of the production cost components of the Alberta fluid milk pricing formula (lagged one quarter). These cost components are: farm inputs (b_5); farm wages (c_5); price of 16 percent dairy feed (d_5); and price of alfalfa hay (e_5). The results are presented in Table 7.5 and Appendix J.

All the estimated coefficients presented in Table 7.5 are significant at either the 0.01 or 0.05 level except for farm wages (c_5), which is insignificant. The expected signs of the coefficients are as expected for farm inputs (b_5) and dairy feed (d_5). The expected sign for alfalfa hay (e_5) was expected to be negative, which is contrary to the positive sign of the results. The coefficients of determination range from 0.71 to 0.75 and the F-values for the equations are significant. Autocorrelation in the models are either inconclusive or do not exist.

As the results in Appendix J indicate, the hypothesis of no serial correlation is accepted at the 0.01 level. The estimated coefficients

TABLE 7.5

Results of Model 5 on Deflated Data

Area	Model Form	Estimated Coefficients							
		a_5	b_5	c_5	d_5	e_5	R^2	D.W.	F-Value
		Intercept	Farm Inputs	Farm Wages	Dairy Feed Prices	Hay Prices			
Alberta	Logarithmic	13.41 (1.396)	-7.849** (-2.657)	2.476 (0.866)	-4.456*** (-3.664)	4.716*** (3.129)	0.75	2.47^{+}	345.95
	Linear	84.540*** (2.839)	-6.266*** (-3.338)	-0.168 (-0.091)	-2.139*** (-3.787)	1.604** (2.616)	0.72	2.02^{++}	127.40
Edmonton	Logarithmic	8.137 0.858	-9.308*** (-3.20)	3.824 (1.354)	-3.359*** (-2.767)	5.539*** (3.721)	0.73	2.58^{+}	283.99
	Linear	22.735 (0.981)	-3.882** (-2.657)	1.209 (0.838)	-1.234*** (-2.807)	1.868*** (3.915)	0.71	2.52^{+}	133.90

Notes: t-values are in parentheses

***The estimated coefficients are significant at the 0.01 level

**The estimated coefficients are significant at the 0.05 level

*The estimated coefficients are significant at the 0.10 level

++The hypothesis of no serial correlation is accepted at the 0.01 level

+Inconclusive test for serial correlation

for farm inputs, dairy feed and hay prices are significant in the logarithmic function for Alberta. In the logarithmic function for Edmonton, the estimated coefficient on the dairy feed variable is the only one which is insignificant. In the linear function for Alberta, the dairy feed coefficient is significant. In the linear function for Edmonton, farm inputs and hay prices are significant. The sign of the estimated coefficients are as expected, except for the hay price variable which again is positive. The R^2's for these equations range from 0.67 to 0.78 and the F-values are significant.

The results of Model 5 indicate that production costs play an important part in determining fluid quota values. One possible reason why the estimated coefficient for farm wages is not significant is that farm wages may not be a major contributor to production cost. Paid farm wages (according to the monthly surveys conducted by the Production Economics Branch, Alberta Agriculture) were approximately 7 percent of total farm costs in 1979.

Results of Model 6.

In Model 6, average fluid milk quota values in Alberta and Edmonton are expressed as a function of the so-called "demand" components (lagged one quarter) of the Alberta fluid milk pricing formula. These components are: the consumer price index (b_6); the wholesale price index (c_6); industrial wages (d_6); and per capita fluid milk consumption in Alberta (e_6). The results are presented in Table 7.6 and in Appendix K.

The results in Table 7.6 are from testing the model with variable X_4(CPI) omitted and where the other variables are deflated by CPI. The only estimated coefficient that is significant at the 0.01 and 0.05 levels is the wholesale price index (c_6). All other estimated coefficients are insignificant. Serial correlation is either inconclusive or the hypothesis of no serial correlation is accepted at the 0.01 level. The

TABLE 7.6

Results of Model 6 on Deflated Data

Area	Model Form	Estimated Coefficients						
		a_6	c_6	d_6	e_6	R^2	D.W.	F-Value
		Intercept	Wholesale Price Index	Industrial Wages	Milk Consumption			
Alberta	Logarithmic	57.546*** (2.832)	(-21.911)*** (-4.032)	0.229 (0.067)	1.236 (1.583)	0.71	1.54^{++}	391.12
	Linear	173.950*** (2.832)	-10.712*** (-3.741)	-1.173 (-0.475)	0.577 (0.928)	0.61	1.14^{+}	121.33
Edmonton	Logarithmic	44.132 (1.603)	-15.927*** (-2.163)	-0.911 (-0.197)	1.153 (1.091)	0.41	0.88^{+}	168.71
	Linear	93.048 (1.586)	-5.97** (-2.183)	-0.177 (-0.075)	0.389 (0.654)	0.39	0.98^{+}	83.34

Notes: t-values are in parentheses
***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

coefficients of determination range from 0.41 to 0.71 in this model. The F-values for the equation are significant. The expected sign for the wholesale price index was positive. Estimated results contradict this expectation. This feature may have arisen because the consumer price index increased at a more rapid rate than did the wholesale price index during the time period of the study.

For the results in Appendix K, autocorrelation is either inconclusive or the hypothesis of no serial correlation is accepted at the 0.01 level. The estimated coefficient of the wholesale price index (c_6), is again significant at the 0.01 level for all equations. The consumer price index is significant in the linear and logarithmic equations for Alberta. The estimated coefficient on the milk consumption variable is significant at the 0.10 level in the Edmonton logarithmic equation. All other estimated coefficients are insignificant in the model. The F-values are significant and R^2 ranges from 0.58 to 0.76. The signs are as expected, except for the wholesale price index which is again negative.

Results of Model 7.

In Model 7, average fluid milk quota values in Alberta and in Edmonton are postulated to be functions of the production cost components (lagged one quarter), steer prices, and the fluid-industrial milk price difference (lagged one quarter). The results are presented in Table 7.7 and in Appendix L.

For the results in Table 7.7, autocorrelation is not evident or is inconclusive. The estimated coefficients of dairy feed prices (d_7) and hay prices (e_7) are significant. The coefficient for steer prices (V_7) is significant in the linear equation for Edmonton at the 0.10 level. All other coefficients are insignificant. The sign in the hay price coefficient is again positive, contrary to what is expected. The

TABLE 7.7

Results of Model 7 on Deflated Data

Area	Model Form	Estimated Coefficients									
		a_7	b_7	c_7	d_7	e_7	V_7	W_7	R^2	D.W.	F-Value
		Intercept	Farm Inputs	Farm Wages	Dairy Feed Prices	Hay Prices	Steer Prices	Milk Price Difference			
Alberta	Logarithmic	27.730*	-3.605	-4.305	-5.645***	3.844**	-1.722	0.019	0.79	2.20^{++}	252.14
		(2.061)	(-0.825)	(-0.788)	(2.838)	(2.399)	(-1.494)	(0.091)			
	Linear	126.291***	-2.681	-5.137	-3.302**	1.166*	-3.072	4.535	0.77	1.82^{++}	97.21
		(3.122)	(-0.968)	(-1.505)	(-3.298)	(1.763)	(-1.421)	(0.869)			
Edmonton	Logarithmic	23.162*	-4.340	-3.626	-5.091**	4.615***	1.705	0.779	0.78	2.36^{+}	212.48
		(1.766)	(-1.018)	(-0.681)	(-2.625)	(2.954)	(-1.517)	(0.391)			
	Linear	61.183*	-0.981	-2.875	-2.008**	1.470***	-2.877*	2.168	0.77	2.40^{+}	105.38
		(1.974)	(-0.462)	(-1.098)	(-2.616)	(2.900)	(1.736)	(0.542)			

Notes: t-values are in parentheses
***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

coefficients of determination for all equations are approximately 0.78 and the F-values are significant at the 0.01 level.

The results in Appendix L indicate that the hypothesis of no serial correlation is accepted. The estimated coefficients of the hay price variable is significant in all equations except the linear equation for Alberta, where dairy feed is the significant coefficient. All other estimated coefficients are insignificant. The coefficient of determination in this model ranges from 0.68 to 0.78. The sign for the hay prices coefficient is again positive, contrary to what was expected.

Results of Model 8.

Model 8 is a symetric matrix of correlation coefficients for the nondeflated components of the Alberta fluid milk pricing formula. The results in Table 7.8 indicate that some of these weighted variables are highly correlated. This suggests that some of these variables could be substituted for each other. For example, the correlation coefficient between the consumer price index and the wholesale price index is 0.986. This suggests that these two variables can be interchangeable, and since the variables move in the same direction, one variable can be eliminated by adjusting the weights in the formula. Of the so-called "demand" components, the consumer price index, the wholesale price index, and industrial wages are highly correlated. Of the so-called "supply" components, farm inputs and farm wages are highly correlated. The weighting of the various index components should be examined in order to determine whether a more appropriate end result may be achieved.

TABLE 7.8

Correlation Coefficients Between the "Composite" Index and its Eight Components in the Alberta Fluid Milk Pricing Formula

	Composite Index	FI	HP	PCP	IW	DF	WPI	FW	CPI
Composite Index	1.00								
FI	0.976	1.00							
HP	0.487	0.363	1.00						
PCP	0.657	0.552	0.474	1.00					
IW	0.977	0.971	0.384	0.592	1.00				
DF	-0.434	-0.432	-0.044	-0.429	-0.545	1.00			
WPI	0.941	0.968	0.208	0.516	0.963	-0.537	1.00		
FW	0.952	0.942	0.366	0.625	0.985	-0.646	0.949	1.00	
CPI	0.967	0.976	0.321	0.556	0.984	-0.529	0.983	0.963	1.00

Summary of the Results

For Models 1 to 4, run on deflated data, the estimated coefficient of average steer prices is significant at the 0.01 level, except in the linear form of Model 3 for Alberta, where it is significant at the 0.05 level. This difference in significance levels may suggest that milk producers direct more attention to beef production when steer prices are relatively high. When steer prices are low, milk producers may shift some of their resources out of beef production and into milk production. The results of these models do suggest an inverse relationship between fluid quota prices and steer prices.

The estimated coefficient of the fluid-industrial milk price difference is significant only in Models 1 and 3 (deflated). The sign for this coefficient is negative, contrary to what is expected. This sign suggests that milk producers do not consider the price difference in real terms.

In the deflated Model 5, the production cost components are significant at the 0.01 and 0.05 levels, except for farm wages. The signs of the significant components are as expected except for the coefficients on the hay variable. These results for the cost components suggest that they influence fluid quota values in Alberta and in Edmonton.

CHAPTER VIII

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary and Conclusions

An attempt has been made in this study to perform three general tasks. First, to describe federal and provincial milk policies, regulations and programs and to discuss how these activities may affect fluid milk quotas in Alberta. Second, a theoretical framework has been outlined to give a basis to examine and evaluate the fluid milk quota program in Alberta. Finally, using statistical techniques, an empirical investigation of the relationship between fluid milk quota values and selected economic indicators has been undertaken.

The interdependence of federal and provincial regulations affecting the marketing of milk was outlined in earlier chapters. Federal milk programs are basically concerned with production of milk for storable products, while provincial programs relate to milk production for perishable products. Each authority essentially has its own pricing mechanism and supply management program. To understand one system, the other must also be considered, particularly in regards to quota policies, regulations, and values.

An area of concern of this study is the capitalization of quota benefits into quota values. The review of theory and literature of this study led to the conclusion that where market supplies are restricted by means of a quota program, capitalization reflects higher expected income for those who own the rights to use the quota. In addition, fluid milk quota provides a means of barriers to entry into the fluid milk market. A method whereby the barriers to entry into the fluid market are reduced, is the graduated entry program. This program has attracted many producers in Alberta and other provinces.

Another area of concern which was discussed are the resource misallocations which may arise from quota programs. In the Alberta dairy industry, these resource misallocations may arise from barriers to entry and from constraints on geographical shifts in production. Geographical shifts in production which could arise from quota being transferred to more efficient areas are restrained because fluid quotas are tied to processing plants. This constraint may be a feature associated with smaller and possibly relatively less efficient size farms in the Edmonton area as compared with the Calgary-Lethbridge area.

Formula pricing of fluid milk in Alberta was also briefly discussed in this study. Some advantages and disadvantages associated with this method of administered pricing were outlined. A brief comparison of formula pricing between provinces was also done.

Fluid quota data in this study were obtained from the Alberta Dairy Control Board and covered the years 1975 to 1979. The data covered Alberta except for the Peace River area. Quarterly average weighted fluid milk quota values in the province during the period of the study ranged from $2.25 to $28.25 (per daily pound). The high average value of $28.25 per pound in Alberta in 1978, was mainly due to high quota values in the Calgary-Lethbridge area. In the Edmonton area, the highest average value reached was $16.00 per pound. In the fourth quarter of 1979, the average fluid quota value in Alberta and Edmonton was $6.25 and $4.00 (per daily pound), respectively.

Following a review of literature which related to the determinants of fluid milk quota values, explanatory variables were proposed for the Alberta dairy industry to explain fluid quota values. The variables selected were: 1) the components of the Alberta fluid milk pricing formula; 2) the average price of A1 and A2 steers in Calgary and Edmonton; and 3) the fluid-industrial milk price difference in Alberta. A single-equation regression model, exploring the relationships of the above explanatory variables with fluid milk quota values in both the province of Alberta and in the Edmonton milkshed, was tested.

A time series approach was used to test the model. The Time Series Package (TSP) computer program was used. The parameters of the various single-equation estimating equations were tested in both (natural) logarithmic and linear form. Ordinary least squares techniques were applied. The variables were considered in both nominal and real terms.

In the investigation of factors associated with fluid milk quota values, the estimated coefficients of average steer prices were related inversely to quota values and were significant in all equations. This suggested that some producers may be both dairy and beef producers. Thus, when beef prices are low, resources may shift to dairying and vice-versa. The results for the fluid-industrial milk price difference variable are not as strong as those for the variable of average steer prices. In only two of the five models tested with this variable is there a significant estimated coefficient for this variable. In the tests of quota values with the price difference variable using deflated data, an inverse relationship appeared, while a positive relationship appeared when the models were tested on nominal data. This suggests that producers may think of fluid-industrial milk price differences in nominal terms rather than in real terms.

When "cost of production" indices were postulated as contributors to fluid quota values, the results revealed a significant relationship for farm inputs, dairy feed and hay prices. The farm wage variable was not significantly associated with fluid milk quota values. This insignificance may be due to farm wages not being a major contributor to total production costs.

A correlation matrix of the components of the Alberta fluid milk pricing formula was constructed. The results showed that some of the components were highly correlated to each other. This suggests that some variables could be omitted to achieve a simpler formula.

Recommendations

The following recommendations arise partly from the perceptions of the shortcomings of this study and partly from analysis of this study. First, simplification of the complex regulations pertaining to the milk industry is necessary. One possible way of achieving this simplification would be to integrate federal and provincial policies and regulations into one. A system where one authority administered and controlled milk marketing would eliminate much of the present duplication. Second, further study on fluid quota policies and values should be undertaken; information on quota values and their determinants should be maintained over time. Third, further study on the "composite" index of the Alberta fluid milk pricing formula should be undertaken. This study should postulate different scenarios for the individual components and examine whether these would change the price of fluid milk. Fourth, changes in present Alberta fluid quota policy should be considered. With modern transportation equipment, fluid milk could economically be transported further, allowing for closures of inefficient processing plants. At the same time, this closure would allow fluid quotas to shift to areas where fluid production is more efficient. Studies to determine the effects of allowing fluid quota to shift to other areas are recommended.

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APPENDIX A:

AVERAGE WEIGHTED PRICE DATA FOR FLUID MILK QUOTA, A1 AND A2 STEERS, AND MILK PRICES DIFFERENCES

YEAR	QT	ALBERTA FLUID MILK QUOTA ($/LB)	EDMONTON FLUID MILK QUOTA ($/LB)	A1,A2 STEERS 1000+ LBS ($/100lbs)	ALBERTA FLUID-INDUSTRIAL MILK PRICE DIFFERENCE ($/CWT)
1974	4	2.25	2.25	47.31	4.09
1975	1	2.34	3.75	38.02	3.99
1975	2	2.65	2.84	43.97	3.83
1975	3	4.72	3.25	45.66	3.48
1975	4	2.60	2.60	43.76	3.68
1976	1	11.00	11.88	37.87	3.93
1976	2	12.43	12.43	40.66	3.89
1976	3	13.66	13.66	36.88	3.88
1976	4	15.08	15.08	36.86	3.88
1977	1	12.63	9.89	35.09	4.26
1977	2	12.16	11.21	38.92	3.85
1977	3	12.80	11.12	40.93	3.85
1977	4	11.24	10.69	44.44	3.85
1978	1	17.52	15.78	45.32	3.96
1978	2	22.22	16.00	61.66	3.80
1978	3	22.36	16.00	61.43	3.72
1978	4	28.25	12.16	62.24	3.72
1979	1	16.49	10.32	74.00	3.60
1979	2	8.37	4.79	79.34	3.48
1979	3	9.19	4.00	74.07	3.81
1979	4	6.25	4.00	74.69	4.34

Source: Alberta Dairy Control Board
Canada Livestock and Meat Trade Report, AGRICULTURE CANADA
Dairy Market Report, AGRICULTURE CANADA

University of Alberta

APPENDIX B:

AVERAGE WEIGHTED DATA FOR THE COMPONENTS OF THE ALBERTA FLUID MILK PRICING FORMULA

YEAR	QT	CONSUMER PRICE INDEX	WHOLESALE PRICE INDEX	INDUSTRIAL WAGES	PER/CAP MILK	"DEMAND" INDEX
1974	4	17.07	17.73	11.48	10.44*	113.84*
1975	1	17.39	18.02	12.11	9.99*	115.03*
1975	2	17.82	17.95	12.47	8.02*	112.52*
1975	3	18.42	18.29	12.89	7.71*	114.53*
1975	4	18.79	18.73	13.17	11.79	124.98
1976	1	19.05	18.68	13.43	11.51	125.35
1976	2	19.26	18.84	13.95	10.67	125.45
1976	3	19.62	19.20	14.38	10.19	126.81
1976	4	19.83	19.13	14.73	12.69	132.24
1977	1	20.22	19.65	15.00	12.25	134.41
1977	2	20.68	20.67	15.58	11.01	135.89
1977	3	21.20	20.84	15.93	9.81	135.57
1977	4	21.57	21.05	16.40	11.93	141.88
1978	1	22.05	21.31	16.55	12.30	144.43
1978	2	22.49	21.89	16.50	11.14	144.04
1978	3	23.24	22.34	16.76	11.25	147.40
1978	4	23.44	23.12	16.99	11.43	149.97
1979	1	23.76	23.89	17.37	11.68	153.37
1979	2	24.60	23.96	17.77	11.89	156.44
1979	3	24.10	23.96	18.37	12.06	158.99
1979	4	25.74	23.96	19.34	12.15	162.37

* estimated

Source: *Production Economics Branch*, ALBERTA AGRICULTURE
The Dairy Review, Statistics Canada, Cat No. 23-001

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APPENDIX B:Continued

AVERAGE WEIGHTED DATA FOR THE COMPONENTS OF THE ALBERTA FLUID MILK PRICING FORMULA

YEAR	QT	FARM INPUTS	FARM WAGES	DAIRY FEED	HAY PRICE	"SUPPLY" INDEX	"COMPOSITE" INDEX
1974	4	11.87	11.86	22.84	20.70	134.54	124.19*
1975	1	12.26	12.55	23.00	18.98	133.58	124.30*
1975	2	12.78	13.06	21.44	20.91	136.37	124.45*
1975	3	12.90	13.26	21.69	21.47	138.64	126.64*
1975	4	13.30	13.41	21.90	22.59	142.71	133.85
1976	1	13.67	14.71	21.28	24.84	149.00	137.18
1976	2	13.90	14.87	21.38	23.65	147.61	136.53
1976	3	14.23	15.38	20.64	23.60	147.05	137.26
1976	4	14.37	16.11	19.20	23.47	146.31	139.53
1977	1	14.55	16.68	19.54	22.40	146.34	140.38
1977	2	14.76	17.05	20.19	22.11	148.22	142.05
1977	3	15.36	17.20	19.39	22.72	149.34	142.46
1977	4	15.78	17.73	17.94	23.01	148.93	145.40
1978	1	15.97	17.80	17.75	23.48	149.99	147.21
1978	2	16.00	17.87	18.26	23.48	151.22	147.63
1978	3	16.35	18.15	17.97	21.61	148.14	147.77
1978	4	17.00	18.59	17.99	21.06	149.36	149.62
1979	1	17.50	19.01	18.22	21.57	152.61	153.00
1979	2	18.95	19.17	18.72	22.36	158.40	157.42
1979	3	19.54	19.71	20.37	23.93	167.09	163.04
1979	4	19.57	19.73	22.38	24.96	173.28	167.83

* estimated

Source: *Production Economics Branch*, ALBERTA AGRICULTURE
The Dairy Review. Statistics Canada, Cat No. 23-001

University of Alberta

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APPENDIX C:

AVERAGE WEIGHTED PRICE DATA FOR FLUID MILK QUOTA, A1 AND A2 STEERS, AND MILK PRICES DIFFERENCES

DEFLATED

YEAR	QT	ALBERTA FLUID MILK QUOTA ($/LB)	EDMONTON FLUID MILK QUOTA ($/LB)	A1,A2 STEERS 1000+ LBS ($/100lbs)	ALBERTA FLUID- * INDUSTRIAL MILK PRICE DIFFERENCE ($/CWT)
1975	1	2.04	3.27	41.60	3.59
1975	2	2.25	2.41	33.10	3.48
1975	3	3.88	2.67	37.40	3.26
1975	4	2.10	2.10	37.60	2.86
1976	1	8.75	9.45	35.30	2.97
1976	2	9.78	9.78	30.10	3.13
1976	3	10.55	10.55	32.00	3.06
1976	4	11.52	11.52	28.50	2.99
1977	1	9.46	7.41	28.20	2.96
1977	2	8.91	8.21	26.30	3.19
1977	3	9.15	7.95	28.50	2.82
1977	4	7.89	7.51	29.30	2.75
1978	1	12.04	10.85	31.20	2.70
1978	2	15.00	10.80	31.20	2.72
1978	3	14.58	10.42	41.60	2.57
1978	4	18.26	7.86	40.10	2.43
1979	1	10.52	6.58	40.20	2.41
1979	2	5.15	2.95	47.20	2.30
1979	3	5.78	2.51	48.90	2.14
1979	4	3.68	2.35	46.60	2.40

* lagged one quarter

Source: Alberta Dairy Control Board
Canada Livestock and Meat Trade Report, AGRICULTURE CANADA
Dairy Market Report, AGRICULTURE CANADA

University of Alberta

APPENDIX D:

AVERAGE WEIGHTED DATA FOR THE COMPONENTS OF THE ALBERTA FLUID MILK PRICING FORMULA

DEFLATED & LAGGED

YEAR	QT	CONSUMER PRICE INDEX	WHOLESALE PRICE INDEX	INDUSTRIAL WAGES	PER/CAP MILK	"DEMAND" INDEX
1975	1	11.38	15.59	10.09	10.44*	108.36*
1975	2	11.48	15.54	10.55	9.99*	108.24*
1975	3	11.76	15.11	10.60	8.02*	101.20*
1975	4	12.16	14.90	10.60	7.71*	99.64*
1976	1	12.40	14.96	10.62	11.79	112.12
1976	2	12.57	14.72	10.68	11.51	110.74
1976	3	12.71	14.67	10.98	10.67	108.96
1976	4	12.95	14.69	11.10	10.19	107.94
1977	1	13.09	14.48	11.25	12.69	115.26
1977	2	13.35	14.58	11.24	12.25	114.22
1977	3	13.65	14.99	11.41	11.01	112.24
1977	4	13.99	14.75	11.39	9.81	107.86
1978	1	14.24	14.64	11.52	11.93	114.28
1978	2	14.55	14.49	11.38	12.30	114.52
1978	3	14.81	14.60	11.14	11.14	110.64
1978	4	15.34	14.42	10.93	11.25	109.80
1979	1	15.47	14.79	10.98	11.43	111.60
1979	2	15.68	15.09	11.08	11.68	113.56
1979	3	16.24	14.61	10.94	11.89	112.32
1979	4	15.91	14.91	11.55	12.06	115.56

* estimated

Source: *Production Economics Branch*, ALBERTA AGRICULTURE
The Dairy Review, Statistics Canada, Cat No. 23-001

APPENDIX D:Continued

AVERAGE WEIGHTED DATA FOR THE COMPONENTS OF THE ALBERTA FLUID MILK PRICING FORMULA

DEFLATED & LAGGED

YEAR	QT	FARM INPUTS	FARM WAGES	DAIRY FEED	HAY PRICE	"SUPPLY" INDEX	"COMPOSITE" INDEX
1975	1	10.43	10.42	20.07	18.20	118.24	113.30*
1975	2	10.68	10.93	19.85	16.37	115.66	111.96*
1975	3	10.87	11.11	18.05	17.60	113.26	108.24*
1975	4	10.60	10.90	17.67	17.49	113.32	106.48*
1976	1	10.73	10.82	17.49	18.03	114.14	113.14
1976	2	10.88	11.70	16.76	19.95	118.58	114.66
1976	3	10.94	11.70	16.65	18.42	115.42	112.20
1976	4	10.99	11.88	15.78	18.05	113.40	110.68
1977	1	10.96	12.31	14.52	17.76	111.10	112.66
1977	2	10.90	12.49	14.49	16.62	109.00	111.62
1977	3	10.81	12.49	14.64	16.04	107.96	110.10
1977	4	10.98	12.29	13.73	16.35	106.70	107.30
1978	1	11.08	12.45	12.48	16.01	104.04	109.16
1978	2	10.98	12.23	12.08	15.98	102.54	108.54
1978	3	10.80	12.07	12.18	15.66	101.42	106.04
1978	4	10.66	11.83	11.60	13.95	96.08	102.94
1979	1	10.99	12.02	11.52	13.49	96.04	103.82
1979	2	11.16	12.12	11.51	13.64	96.86	105.22
1979	3	11.67	11.80	11.42	13.64	97.06	104.70
1979	4	12.28	12.39	12.68	14.90	104.50	110.04

* estimated

Source: *Production Economics Branch*, ALBERTA AGRICULTURE
The Dairy Review, Statistics Canada, Cat No. 23-001

University of Alberta

APPENDIX E

Natural Logarithmic Regression Equations: Models 1 to 7

Model 1.

$$\ln Q_t = \ln a_1 + b_1 \ln X_{1_{t-1}} + V_1 \ln S_t + W_1 \ln D_{t-1} + \ln u_t$$

where the variables are as defined in Chapter VI.

Model 2.

$$\ln Q_t = \ln a_2 + b_2 \ln X_{2_{t-1}} + c_2 \ln X_{3_{t-1}} + V_2 \ln S_t + W_2 \ln D_{t-1} + \ln u_t$$

where the variables are as defined in Chapter VI.

Model 3.

$$\ln Q_t = \ln a_3 + b_3 \ln X_{2_{t-1}} + V_3 \ln S_t + W_3 \ln D_{t-1} + \ln u_t$$

where the variables are as defined in Chapter VI.

Model 4.

$$\ln Q_t = \ln a_4 + b_4 \ln X_{3_{t-1}} + V_4 \ln S_t + W_4 \ln D_{t-1} + \ln u_t$$

where the variables are as defined in Chapter VI.

Model 5.

$$\ln Q_t = \ln a_5 + b_5 \ln X_{8_{t-1}} + c_5 \ln X_{9_{t-1}} + d_5 \ln X_{10_{t-1}} + e_5 \ln X_{11_{t-1}} + \ln u_t$$

where the variables are as defined in Chapter VI.

Model 6.

$$\ln Q_t = \ln a_6 + b_6 \ln X_{4_{t-1}} + c_6 \ln X_{5_{t-1}} + d_6 \ln X_{6_{t-1}} + e_6 \ln X_{7_{t-1}} + \ln u_t$$

where the variables are as defined in Chapter VI.

Model 7.

$$\ln Q_t = \ln a_7 + b_7 \ln X_{8_{t-1}} + c_7 \ln X_{9_{t-1}} + d_7 \ln X_{10_{t-1}} + e_7 \ln X_{11_{t-1}} + V_7 \ln S_t + W_7 \ln D_{t-1} + \ln u_t$$

where the variables are as defined in Chapter VI.

APPENDIX F

Results of Model 1 on Nominal Data

Area	Model Form	Estimated Coefficients							
		a_1	b_1	V_1	W_1	R^2	D.W.	RHO	F-Value
		Intercept	"Composite" Index	Steer Prices	Milk Price Difference				
Alberta	Logarithmic	-39.076*** (-3.521)	9.088*** (3.673)	-1.283 (-1.693)	1.056 (0.344)	0.49	0.69^{+++}		252.80
	Logarithmic[1]	-6.938 -0.373	2.135 (0.531)	-1.133 (-1.351)	2.489 (1.166)	0.67	2.10^{++}	0.704	484.62
	Linear	-53.997 (-1.347)	0.454*** (2.100)	-0.141 (-0.819)	3.487 (0.3747)	0.26	0.57^{+++}		54.25
	Linear[1]	21.128 (0.398)	-0.059 (-0.162)	-0.247 (-1.360)	4.33 (0.740)	0.64	1.68^{++}	0.814	122.92
Edmonton	Logarithmic	-32.504*** (-3.226)	7.749*** (3.456)	-1.795** (-2.609)	2.423 (0.868)	0.48	0.56^{+++}		253.22
	Logarithmic[1]	-8.685 (-0.479)	2.551 (0.663)	-1.660** (-2.211)	3.571* (1.934)	0.74	1.69^{++}	0.749	509.01
	Linear	-45.741 (-1.670)	0.392*** (2.855)	-0.263** (-2.409)	3.491 (0.588)	0.39	0.58^{+++}		83.02
	Linear[1]	-12.432 (-0.417)	-0.072 (0.339)	-0.203* (-1.770)	6.178 (1.611)	0.71	1.68^{++}	0.739	178.41

[1] Cochrane-Orcutt Iterative Technique

Notes: t-values are in parentheses

***The estimated coefficients are significant at the 0.01 level

**The estimated coefficients are significant at the 0.05 level

*The estimated coefficients are significant at the 0.10 level

+++Serial correlation is evident

++The hypothesis of no serial correlation is accepted at the 0.01 level

+Inconclusive test for serial correlation

APPENDIX G

Results of Model 2 on Nominal Data

Area	Model Form	Estimated Coefficients					R^2	D.W.	RHO	F-Value
		a_2	b_2	c_2	V_2	W_2				
		Intercept	"Demand" Index	"Supply" Index	Steer Price	Milk Price Difference				
Alberta	Logarithmic	-14.836 (-0.874)	9.880*** (2.999)	-4.691 (-0.867)	-1.995** (-2.448)	-0.056 (-0.019)	0.58	0.88^{+}		230.21
	Logarithmic[1]	3.322 (0.188)	6.035** (2.072)	-5.882 (-1.268)	-1.194 (-1.561)	2.688 (1.290)	0.72	2.11^{++}	0.606	435.05
	Linear	13.462 (0.272)	-0.823*** (2.950)	-0.637 (-1.625)	-0.352** (-1.965)	-0.109 (-0.013)	0.45	0.74^{+}		55.75
	Linear[1]	24.26 (0.548)	0.422 (1.590)	-0.492 (-1.453)	-0.240 (-1.405)	4.612 (0.800)	0.69	1.52^{+}	0.709	108.82
Edmonton	Logarithmic	-12.950 (-0.823)	8.179** (2.677)	-3.572 (-0.713)	-2.372*** (3.141)	1.520 (0.557)	0.55	0.75^{+}		221.19
	Logarithmic[1]	-1.983 (-0.111)	4.126 (1.460)	-2.897 (-0.671)	-1.663** (-2.284)	3.677* (1.962)	0.76	1.69^{++}	0.694	412.86
	Linear	-14.976 (-0.436)	0.453*** (2.344)	-0.175 (-0.644)	-0.355*** (-2.862)	1.921 (0.328)	0.46	0.77^{+}		70.97
	Linear[1]	-7.309 (-0.244)	0.172 (0.951)	-0.127 (-0.551)	-0.213* (-1.837)	6.420 (1.622)	0.72	1.65^{++}	0.698	139.14

[1] Cochrane-Orcutt Iterative Technique

Notes: t-values are in parentheses
***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
+++Serial correlation is evident
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

APPENDIX H

Results of Model 3 on Nominal Data

Area	Model Form	Estimated Coefficients							
		a_3	b_3	V_3	W_3	R^2	D.W.	RHO	F-Value
		Intercept	"Demand" Index	Steer Prices	Milk Price Difference				
Alberta	Logarithmic	-27.943*** (-3.647)	7.469*** (4.243)	-1.759** (-2.308)	0.376 (0.130)	0.56	0.77^{+++}		292.11
	Logarithmic[1]	-13.868 (-1.259)	3.712 (1.492)	-1.283 (-1.638)	2.326 (1.115)	0.70	1.90^{++}	0.631	523.13
	Linear	-42.679 (-1.146)	0.449** (2.710)	-0.253 (-1.430)	1.880 (0.214)	0.36	0.58^{+++}		62.62
	Linear[1]	-13.225 (-0.357)	0.205 (0.809)	-0.268 (-1.513)	3.339 (0.576)	0.65	1.46^{++}	0.753	126.82
Edmonton	Logarithmic	-22.931*** (-3.255)	6.344*** (3.920)	-2.192*** (-3.128)	1.850 (0.698)	0.53	0.65^{+++}		285.14
	Logarithmic[1]	-10.862 (-0.962)	3.078 (1.250)	-1.722** (-2.411)	3.490* (1.932)	0.75	1.62^{++}	0.713	536.17
	Linear	-30.398 (-1.260)	0.351*** (3.262)	-0.328*** (-2.863)	2.467 (0.434)	0.45	0.67^{+++}		91.94
	Linear[1]	-17.03 (-0.747)	0.115 (0.740)	-0.218* (-1.920)	6.072 (1.601)	0.71	1.62^{++}	0.713	182.49

[1] Cochrane-Orcutt Iterative Technique

Notes: t-values are in parentheses
***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
+++Serial correlation is evident
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

APPENDIX I

Results of Model 4 on Nominal Data

Area	Model Form	Estimated Coefficients							
		a_4	b_4	V_4	W_4	R^2	D.W.	RHO	F-Value
		Intercept	"Supply" Index	Steer Prices	Milk Price Difference				
Alberta	Logarithmic	-43.659** (-2.551)	8.970** (2.518)	-0.368 (-0.494)	1.953 (0.556)	0.32	0.67^{+++}		190.53
	Logarithmic[1]	18.521 (0.851)	-3.097 (-0.688)	-1.086 (-1.292)	3.008 1.449	0.68	2.37^{++}	0.773	493.49
	Linear	-56.075 (-1.058)	0.317 (1.171)	0.020 (0.131)	5.390 (0.537)	0.13	0.60^{+++}		45.57
	Linear[1]	64.802 (1.294)	-0.361 (-1.112)	-0.251 (-1.429)	5.631 (1.009)	0.66	1.74^{++}	0.842	132.60
Edmonton	Logarithmic	-36.812** (-2.414)	7.737** (2.438)	-1.025 (-1.546)	3.184 (1.018)	0.33	0.55^{+++}		198.30
	Logarithmic[1]	6.398 (0.325)	-0.625 (0.154)	-1.558* (-2.054)	3.902* (2.104)	0.73	1.84^{++}	0.785	497.12
	Linear	-53.242 (-1.559)	0.349* (2.009)	-0.150 (-1.508)	4.947 (0.765)	0.27	0.522^{+++}		68.19
	Linear[1]	2.189 (-0.071)	-0.040 (-0.196)	-0.188 (-1.690)	6.581* (1.730)	0.70	1.78^{++}	0.761	177.60

[1] Cochrane-Orcutt Iterative Technique

Notes: t-values are in parentheses

***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
+++Serial correlation is evident
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

APPENDIX J

Results of Model 5 on Nominal Data

Area	Model Form	Estimated Coefficients							
		a_5	b_5	c_5	d_5	e_5	R^2	D.W.	F-Value
		Intercept	Farm Inputs	Farm Wages	Dairy Feed Prices	Hay Prices			
Alberta	Logarithmic	4.375 (0.430)	-4.551* (-1.819)	3.861 (1.274)	-4.834** (-1.971)	4.498** (2.799)	0.78	2.21^{++}	439.82
	Linear	71.803 (1.594)	-2.136 (-1.095)	0.847 (0.353)	-3.516** (-2.291)	1.298 (1.593)	0.67	1.62^{++}	95.20
Edmonton	Logarithmic	-1.459 (-0.149)	-7.258*** (-3.005)	5.354* (1.831)	-2.945 (-1.244)	5.509*** (3.553)	0.74	2.36^{++}	389.53
	Linear	8.338 (0.296)	-3.101** (-2.539)	1.881 (1.254)	-1.327 (-1.382)	1.962* (3.847)	0.74	2.33^{++}	148.66

Notes: t-values are in parentheses
***The estimated coefficient is significant at the 0.01 level
**The estimated coefficient is significant at the 0.05 level
*The estimated coefficient is significant at the 0.10 level
+++Serial correlation is evident
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

APPENDIX K

Results of Model 6 on Nominal Data

Area	Model Form	Estimated Coefficients							
		a_6	b_6	c_6	d_6	e_6	R^2	D.W.	F-Value
		Intercept	Consumer Price Index	Wholesale Price Index	Industrial Wages	Milk Consumption			
Alberta	Log.	-1.724 (-0.405)	20.832** (2.581)	-22.049*** (-3.967)	1.535 (0.389)	1.376 (1.633)	0.76	1.59++	407.15
	Linear	-2.821 (-0.195)	12.678*** (2.912)	-11.813*** (-3.672)	-0.905 (-0.300)	-0.692 (0.688)	0.63	1.12+	85.04
Edmonton	Log.	6.604 (1.403)	11.508 (1.290)	-18.732*** (-3.050)	4.630 (1.063)	1.921* (2.063)	0.64	1.40+	274.07
	Linear	18.302* (1.70)	4.621 (1.423)	-7.621*** (-3.176)	2.701 (1.200)	0.971 (1.294)	0.58	1.45+	92.60

Notes: t-values are in parentheses
***The estimated coefficient is significant at the 0.01 level
**The estimated coefficient is significant at the 0.05 level
*The estimated coefficient is significant at the 0.10 level
+++Serial correlation is evident
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

APPENDIX L

Results of Model 7 on Nominal Data

Area	Model Form	Estimated Coefficients									
		a_7	b_7	c_7	d_7	e_7	V_7	W_7	R^2	D.W.	F-Value
		Intercept	Farm Inputs	Farm Wages	Dairy Feed Prices	Hay Prices	Steer Prices	Milk Price Difference			
Alberta	**Logarithmic**	6.191	-3.751	3.353	-5.141	4.207*	-0.208	0.015	0.78	2.11^{++}	273.33
		(0.452)	(-0.798)	(0.794)	(-1.70)	(1.948)	(-0.223)	(0.020)			
	Linear	58.189	-2.871	1.141	-3.335*	1.576	0.086	1.494	0.68	1.80^{++}	60.03
		(1.031)	(-0.842)	(0.362)	(-1.784)	(1.423)	(0.423)	(0.199)			
Edmonton	**Logarithmic**	1.646	-4.646	3.397	-3.987	4.880**	-0.419	1.470	0.75	2.11^{++}	252.98
		(0.127)	(-1.05)	(0.852)	(-1.393)	(2.393)	(-0.475)	(0.635)			
	Linear	5.817	-2.524	1.384	-1.556	1.895**	0.0132	2.250	0.74	2.27^{++}	93.83
		(0.165)	(-1.185)	(0.703)	(-1.331)	(2.737)	(-0.105)	(0.482)			

Notes: t-values are in parentheses

***The estimated coefficients are significant at the 0.01 level
**The estimated coefficients are significant at the 0.05 level
*The estimated coefficients are significant at the 0.10 level
+++Serial correlation is evident
++The hypothesis of no serial correlation is accepted at the 0.01 level
+Inconclusive test for serial correlation

APPENDIX M

GOVERNMENT OF THE PROVINCE OF ALBERTA
ALBERTA REGULATION 169/75

(Filed June 4, 1975)
THE DAIRY BOARD ACT
(O.C. 740/75)

THE ALBERTA PLAN FOR MILK MARKET SHARING

Allotment of Market Sharing Quotas to Producers

7. (1) The Dairy Board shall allot market sharing quotas from the provincial entitlement as agreed to under the comprehensive milk marketing plan to fluid milk producers and industrial producers of milk and cream in accordance with this section.

(2) During the 1975-76 dairy year, the Dairy Board shall automatically allot free market sharing quotas to any licensed producer whose production of industrial milk or cream is greater than his market sharing quota.

(3) The additional amount of market sharing quota allotted under subsection (2) shall be equal to the individual producer's total industrial milk or cream shipments during the current dairy year.

(4) During the 1975-76 dairy year a new producer or a producer re-entering the dairy industry shall upon application to the Dairy Board be granted a market sharing quota of 12,000 pounds of milk if he is a milk producer or 420 pounds of butterfat if he is a cream shipper.

(5) Where the amounts specified in subsection (4) are exceeded, additional quota will be allotted in accordance with subsections (2) and (3).

(6) A new fluid milk producer will be allotted a market sharing quota equal to 13 per cent of his fluid sales.

(7) Nothing in this section shall be deemed to require the Dairy Board to allot any quota where the provincial entitlement would be exceeded.

(8) When an industrial producer is allotted a fluid milk quota, he shall relinquish to the Alberta Reserve a market sharing quota equal to the fluid milk quota allotted, but in no case shall the producer's market sharing quota be less than 13 per cent of his portion of fluid sales.

Transfers of Market Sharing Quotas

8. (1) A producer may transfer the market sharing quota in whole or in part to another producer in accordance with these regulations.

(2) All transfers of market sharing quotas must be approved by the Dairy Board.

(3) All applications for transferring of market sharing quotas must be made by the transferee to the Board on forms supplied by the Dairy Board.

APPENDIX M (CONTINUED)

(4) When an application for the transfer of a market sharing quota is approved by the Dairy Board in any month, the transfer will become effective the first day of the month following and the transferor's market sharing quota will be accordingly reduced or cancelled on the date that the transfer becomes effective.

(5) The Dairy Board will not approve of a transfer of market sharing quota where the amount of the quota being transferred is less than 12,000 pounds of milk at 3.5 per cent of butterfat or 420 pounds of butterfat per dairy year.

(6) Except by permission of the Dairy Board a producer who acquires additional market sharing quota shall not be permitted to transfer a portion of this total market sharing quota during a period of 12 months following the date on which the producer acquired the additional market sharing quota.

(7) Except by permission of the Board, a producer who disposes of all or any portion of his market sharing quota will not be permitted to acquire additional market sharing quota within a 12 month period following the date on which he disposed of the market sharing quota.

(8) An industrial milk producer shall not be permitted to transfer any portion of his market sharing quota if such a transfer would leave the producer holding a market sharing quota of less than 12,000 pounds of milk at 3.5 per cent of butterfat or 420 pounds of butterfat per dairy year.

(9) A transfer from a cream producer of the producer's market sharing quota will not be approved if the transfer would leave the cream producer holding a market sharing quota of less than 420 pounds of butterfat per year.

(10) A fluid producer who transfers all or part of his fluid quota must transfer at least an amount of market sharing quota equivalent to 13 per cent of fluid sales related to the amount of fluid quota transfered.

(11) A fluid producer may not by transfer reduce his market sharing quota below 13 per cent of his fluid sales.

(12) When a producer transfers all of the market sharing quota allotted to him to another producer, the unused portion of the market sharing quota will be available to the purchaser for the dairy year in which the transfer is approved, and in the next dairy year the whole of the acquired market sharing quota will be available, subject to maintenance requirements in the year of transfer.

(13) When a producer transfers a part of the market sharing quota allotted to him and retains part in his own name, the amount available to the purchaser for the dairy year in which the application is approved will be the amount of the reallocation, except where a lesser amount is specified on the application form.

(14) A producer may transfer all or part of his market sharing quota to a member of his immediate family who continues to produce milk on the same farm.

Market Sharing Quota Adjustments

9. When changes occur in the Canadian domestic market for industrial milk or cream the Dairy Board may adjust the producer's market sharing quota in accordance with the comprehensive milk marketing plan.

10. The Dairy Board may utilize the Alberta reserve

(a) where the Dairy Board deems it necessary to adjust the allotment of market sharing quota held by producers, or any one producer, or

(b) to allot market sharing quotas to a registered non-quota holder when his production exceeds 420 pounds of butterfat per dairy year.

APPENDIX M (CONTINUED)

Market Sharing Quota Maintenance Requirements

11. (1) A producer is required to market at least 95 per cent of the market sharing quota available to him in the 1975-76 dairy year.

(2) Where a producer markets less than the amount prescribed in subsection (1), his market sharing quota for the 1976-77 dairy year will be reduced to his 1975-76 deliveries.

(3) Notwithstanding subsection (2), a fluid producer's market sharing quota shall not be reduced below an amount equal to 13% of his Class 1 sales as expressed on an annual basis.

(4) A producer who increases the market sharing quota which he holds will be required to market 85 per cent of the annual equivalent market sharing quota available to him to avoid a quota reduction.

(5) A producer who reduces the market sharing quota which he holds will be required to market at least 85 per cent of the new annual market sharing quota available to him in order to avoid a further quota reduction.

Assessment and Levies

12. (1) Each holder of a market sharing quota shall be assessed levies as ordered by the Dairy Board in accordance with the comprehensive milk marketing plan, at the rate established by the Commission.

(2) Each producer is hereby assessed by the Dairy Board three tenths of a cent per pound of butterfat delivered or one cent per hundredweight for industrial milk delivered.

(3) Each processor shall, before making payment to a producer, deduct from the total amount payable to such producer the amounts levied by the Dairy Board pursuant to subsection (2) and shall forthwith pay the amounts so deducted to the Dairy Board.

13. Alberta regulation 74/72 as amended is hereby rescinded.

(Extract from *The Alberta Gazette*, June 30, 1975)

APPENDIX N

GOVERNMENT OF THE PROVINCE OF ALBERTA

ALBERTA REGULATION 334/74

(Filed December 18, 1974)

THE DAIRY BOARD ACT
(O.C. 2046/74)

Quotas

13. The Dairy Board shall determine the needs of processors and shall allot daily quotas to licensed producers supplying milk to processors.

14. A daily milk quota allotted to a licensed producer by the Dairy Board shall remain in effect until it is suspended or revoked or changed in accordance with these regulations.

15. (1) In January of each year the Dairy Board shall make any necessary adjustments in the daily quota allotted to each producer based on the average daily processor's milk sales during the preceding calendar year and shall allot the quota to any additional producers where necessary to meet the processor's sales requirements.

(2) Notwithstanding subsection (1), where the Dairy Board considers it necessary to do so, it may make adjustments in quota at any time.

16. In January of each year the Dairy Board may reduce the quota of any licenced producer who has failed to deliver the full amount of his quota, calculated on a daily basis, during the quota period.

17. The quota made available as the result of the reduction of a producer's quota shall be allotted by the Dairy Board to licensed producers or to new producers in such proportions as the Dairy Board may determine.

18. The quota of a producer may be increased by the Dairy Board where that producer ships more than his daily quota during the quota period.

19. The Dairy Board shall not adjust the quota of any licensed producer where all or part of the milk delivered by him to a processor is classified as being off-flavour.

20. No producer shall transfer quota unless

(a) at least two years have expired from the date that the quota was allotted, and

(b) the Dairy Board approves the transfer.

21. A person who transfers all or part of his quota shall not receive any further allotment from the Dairy Board until the second annual quota adjustment following that transfer.

22. (1) An application for the transfer of quota shall be submitted to the Dairy Board at least 14 days prior to the proposed transfer date.

(2) A transfer of quota must be effective on the first day of a month.

23. (1) Each producer shall deliver his quota every month to the processor to whom he is assigned.

(2) Except where milk is picked up every other day the producer's deliveries shall be twice his daily quota.

(3) The period between two deliveries of milk from a producer shall not exceed two days.

24. (1) A processor shall accept all milk delivered in accordance with these regulations by the producers assigned to him.

(2) The Dairy Board may transfer a licensed producer to such processor as it may designate.

Graduated Entry

25. A person who

(a) is a resident of Alberta,

(b) has marketed milk or cream to an Alberta plant for the 12 consecutive months prior to September 1 of the year of application,

(c) has marketed a daily average of at least 500 pounds of milk or the cream equivalent thereof for those 12 months,

(d) submits an application prior to September 1 for entry on January 1 of the following year,

(e) has farm premises which meet the requirements for Alberta fluid milk production and are approved pursuant to regulations under The Dairymen's Act prior to December 1 of the year of application or in the case of a cream producer who is converting to milk, such later date as the Dairy Board may determine,

(f) has installed a bulk tank of sufficient capacity to store at least five milkings, and

(g) has a milk production quality record both past and present which meets the requirements of regulations under The Dairymen's Act and Division 9 of The Provincial Board of Health Regulations under The Public Health Act,

may over a three-year period be allotted a daily milk quota by the Dairy Board in accordance with section 26.

26. (1) The Dairy Board shall in accordance with this section compute the quota to be allotted to an applicant (graduated entrant) under section 25.

(2) The entrant shall receive a total quota equivalent to his basic daily production up to a maximum of 800 pounds per day.

(3) The entrant shall receive 50 per cent of his quota on January 1 of the year of entry and an additional 25 per cent on January 1 of each of the next following two years.

(4) Where more applicants than are required qualify the Dairy Board may conduct a draw and allot quota in accordance with the results.

(5) Where an applicant qualifies but no quota is available, his application shall have priority in succeeding years.

(6) The entrant must maintain his daily basic production during the period of graduated entry and where this declines, his allotted total quota shall be reduced by a proportionate amount.

27. (1) Upon completion of graduated entry, the entrant shall in subsequent years be eligible for a quota increase based on production on the same basis as other fluid milk quota holders.

(2) The entrant or successful applicant may not transfer his right to graduated entry or his remaining entitlement except to a person who is a member of his immediate family or to a person who is purchasing his farm, buildings and herd as a going concern.

(Extract from *The Alberta Gazette*, December 31, 1974)